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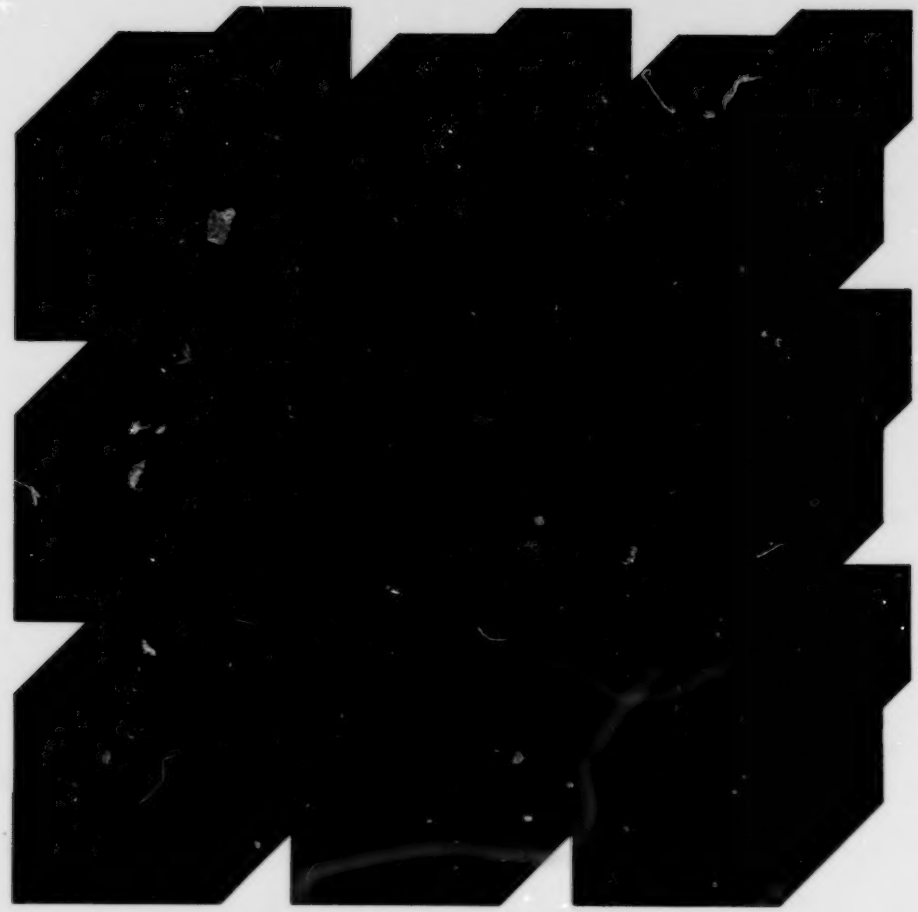

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DISCUSSION PAPER No. 331

Impact of Canada-U.S. Free Trade
on the Canadian Economy

by Sunder Magun,
Someshwar Rao
and Bimal Lodh

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RÉSUMÉ

Les exportations intervenant pour plus de 30 % du produit intérieur brut du Canada, il est clair que le commerce extérieur représente l'une des pierres d'assise de l'économie canadienne. Les échanges entre le Canada et les États-Unis revêtent une toute première importance car, malgré les efforts faits dans le passé pour diversifier nos marchés, ils ont continué de croître pour passer de 66 % de l'ensemble du commerce extérieur du Canada en 1981 à plus de 75 % à l'heure actuelle. De toute évidence, un régime d'échanges internationaux libéralisé et stable, particulièrement avec les États-Unis, est d'une importance capitale pour le maintien de la prospérité au pays.

Dans plusieurs de ses publications au cours de la dernière décennie, le Conseil économique a préconisé une plus grande libéralisation des échanges comme moyen d'améliorer le fonctionnement des marchés et de relever le niveau de vie des Canadiens. Malgré les nombreux avantages économiques qu'entraînerait une libéralisation des échanges, le Conseil reconnaît que le processus d'adaptation à un nouveau régime d'échanges provoquerait certains bouleversements sur le marché du travail et entraînerait une certaine rationalisation au niveau des secteurs industries. Même si la libéralisation des échanges va s'accompagner de gains nets sur les plans de la production, de l'emploi et du revenu réel, certaines entreprises et certains travailleurs seront confrontés à des problèmes d'adaptation provisoires. Les pouvoirs publics et les Canadiens en général doivent donc connaître quelles industries et régions seront les gagnantes et les perdantes par suite d'un accord bilatéral de libre-échange. Par conséquent, l'un des premiers objectifs du présent document consiste à déterminer qui en seront vraisemblablement les gagnants et les perdants.

LE LIBRE-ÉCHANGE BILATÉRAL

Dans son Exposé annuel de 1986, le Conseil a publié les résultats de simulations faisant état de l'incidence d'un accord de libre-échange canado-américain sur l'ensemble de la production et de l'emploi au Canada. Or, il ressort de ces simulations qu'un régime de libre-échange bilatéral avec les États-Unis se traduirait par une augmentation appréciable du produit national brut réel au Canada, surtout si l'élargissement des marchés s'accompagnait d'une amélioration de la productivité au pays (résultant, entre autres choses, d'économies d'échelle plus importantes et d'une spécialisation plus poussée). Le Conseil a réalisé depuis de nouveaux travaux majeurs dans ce domaine. Il a effectué des calculs plus à jour du coût du protectionnisme entre les deux pays (y compris les barrières tarifaires et non tarifaires). À cet égard, il appert que les tarifs douaniers

applicables aux produits importés par le Canada sont en moyenne beaucoup plus élevés que ceux en vigueur aux États-Unis (11,2 % de la valeur totale des importations canadiennes en provenance des États-Unis et sujettes à des droits de douane, contre 6,5 % pour les exportations canadiennes vers les États-Unis). Par contre, les barrières non tarifaires sont généralement plus élevées aux États-Unis qu'au Canada (1,8 % comparativement à 1,0 %). Le Conseil a aussi effectué des calculs des gains de productivité dont seraient susceptibles de profiter les divers secteurs industriels suite à un accord commercial bilatéral.

SCÉNARIOS DE LIBRE-ÉCHANGE

Deux scénarios ont été développés afin d'illustrer les effets qu'aurait un régime de libre-échange canado-américain sur les projections de l'économie canadienne mises au point à l'aide su scénario de référence du Conseil. Dans le premier cas, toutes les barrières tarifaires et non tarifaires sur les échanges de produits entre les deux pays ont été éliminées (à l'exclusion des subventions agricoles et autres, ainsi que des échanges de services). Dans le deuxième cas, on a ajouté à la suppression des barrières commerciales des hausses de productivité propres à chaque industrie du secteur manufacturier canadien.

D'après les résultats de nos simulations, le libre-échange créerait jusqu'à 350 000 nouveaux emplois au Canada d'ici 1995, ne causant que des pertes d'emplois relativement minimes dans un nombre restreint d'industries en déclin. En outre, les gains sur les plans de l'emploi et de la production seraient répartis à peu près uniformément dans toutes les régions.

RÉPERCUSSIONS SECTORIELLES

Alors que les effects directs d'une libéralisation du commerce sont préjudiciables aux industries canadiennes fortement protégées, surtout dans le secteur manufacturier, toutes les industries profitent indirectement de l'augmentation globale des investissements et des dépenses de consommation (suscitée par le coût moins élevé des importations en provenance des États-Unis). Dans le premier scénario, l'incidence globale (tenant compte des effets directs et indirects) d'une entente de libre-échange bilatérale sur la production et l'emploi est positive et significative dans 29 des 36 industries examinées. Dans le deuxième scénario, 30 industries enregistrent des gains sur les plans de la production et de l'emploi.

Les industries primaires telles que l'exploitation foretière, l'agriculture et la pêche bénéficieraient considérablement de l'élimination des barrières non tarifaires. Dans le secteur des services, quatre industries - le commerce de détail, le commerce de gros, les services aux entreprises et les services personnels - interviendraient pour près de 65 % de tous les nouveaux emploi. Les gains substantiels qui seraient réalisés aux titres de la production et de l'emploi dans le secteur des services

s'expliquent par l'importance croissante que prennent les services dans l'économie canadienne. Les sept industries qui connaîtraient une diminution de la production et de l'emploi font partie du secteur manufacturier : le caoutchouc et les matières plastiques, le cuir, les textiles, la bonneterie, les produits électriques, les produits chimiques et les industries manufacturières diverses. Ces industries sont fortement protégées et doivent déjà faire face à une vive concurrence de la part des pays en développement où la main-d'oeuvre est faiblement rémunérée. La réduction nette de l'emploi dans ces industries serait d'environ 16 000 dans le premier scénario, et de moins de 7 000 dans le second. Dans l'ensemble, les industries manufacturières retireraient des avantages appréciables de la libéralisation des échanges en raison de la création de plus de 42 000 nouveaux emplois dans ce secteur.

RÉPERCUSSIONS RÉGIONALES

Dans la mesure où les pertes d'emplois seraient concentrées dans des régions défavorisées ou dans des collectivités à industrie unique, le libre-échange rendrait plus aigus les problèmes d'adaptation dans ces régions. Toutefois, en augmentant les revenus et l'emploi dans l'ensemble du pays, le libre-échange renforcerait la capacité financière des gouvernements à fournir une aide à l'adaptation. En outre, selon les résultats des simulations, les bénéfices du libre-échange seraient répartis à peu près uniformément dans toute les provinces. Les provinces de l'Atlantique, l'Alberta et la Colombie-Britannique retireraient des gains de production et d'emploi légèrement supérieurs à la moyenne, en raison de la concentration plus élevée des industries primaires et de la construction que l'on relève dans ces provinces. Le Québec et l'Ontario auraient à supporter la plus grande part des coûts d'adaptation (environ 90 %), étant donné la forte concentration d'industries manufacturières dans ces provinces (qui interviennent pour environ 75 % de toute la production manufacturière au Canada). Par ailleurs, ces provinces recevraient aussi la part du lion de l'ensemble des avantages (environ 60 %).

En résumé, il ressort de nos simulations que le Canada retirerait des avantages appréciables d'un accord bilatéral de libre-échange avec les États-Unis, alors que presque tous les secteurs de la production et de la consommation et profiteraient dans l'ensemble des provinces. L'importance de ces effets dépend de la nature du libre-échange que sous-tendent les hypothèses retenues, ainsi que de la structure et des propriétés des modèles utilisés pour simuler ces répercussions. Ce qui importe toutefois, c'est le caractère des résultats; ceux-ci indiquent clairement que tous les Canadiens retireraient des avantages économiques appréciables d'un accord de libre-échange entre le Canada et les États-Unis. La dernière partie du document analyse les éléments qui pourraient accroître ou diminuer l'importance des répercussions décrites ci-dessus; l'auteur en conclut que les résultats ne comportent aucun biais dans un sens ou dans l'autre.

ABSTRACT

With exports accounting for more than 30 per cent of Canada's gross domestic product, it is clear that international trade is the lifeblood of the Canadian economy. Most important of all is Canada's trade with the United States, which has steadily increased, in spite of past efforts to diversify our markets, from 66 per cent of total Canadian trade in 1981 to more than 75 per cent today. Clearly a stable and liberal international trading regime, especially in relation to the United States, is crucial to this country's continuing prosperity.

In several of its publications over the past decade, the Economic Council has called for greater trade liberalization as a way to improve the working of Canadian markets and to enhance Canadian living standards. While there are many economic advantages to trade liberalization, the Council also recognizes that job dislocation and industry rationalization are an inevitable part of the trade-adjustment process. Although trade liberalization offers net gains in output, employment, and real incomes, there will be firms and employees facing transitional adjustment problems. Governments and Canadians generally must know which industries and regions will be the winners and losers from a bilateral free-trade agreement. A primary objective of this paper, therefore, is to determine who the winners and the losers are likely to be.

BILATERAL TRADE

In its 1986 Annual Review of the economy, the Council reported the simulated impact of a Canada-U.S. free-trade agreement on aggregate output and employment in Canada. These simulation results suggested that bilateral free trade with the United States would result in a significant increase in Canadian real gross national product, particularly if wider market opportunities were accompanied by domestic productivity improvements (resulting from greater economies of scale, production specialization, and so on). Since then, the Council has done considerable new work in this area. It has developed new and more up-to-date estimates of the cost of trade protection (including both tariff and nontariff barriers) between the two countries. In this respect, it found that average Canadian tariff rates on goods are considerably higher than U.S. ones (11.2 per cent of the total value of dutiable Canadian imports from the United States, compared to 6.5 per cent for Canadian exports to the United States). Nontariff barriers, on the other hand, are generally higher in the United States (1.8 per cent, compared to 1.0 per cent). The Council has also developed industry-specific estimates of the potential productivity gains that are likely to result from a bilateral trade pact.

FREE-TRADE SCENARIOS

To illustrate the effects of Canada-U.S. free trade on the Council's base-case projections for the Canadian economy, two scenarios were developed. In the first, all tariff and nontariff barriers on goods traded between the two countries are removed (excluding agricultural and other subsidies, and trade in services). In the second, free trade is supplemented by industry-specific productivity improvements in Canadian manufacturing industries.

Our results suggest that free trade will create as many as 350,000 new jobs in Canada by 1995, while causing only relatively small job losses in a handful of declining industries. As well, the gains in employment and net output will be distributed fairly uniformly across all regions.

In both scenarios the impact of bilateral free trade improves real wages, increases output and employment, stimulates business investment and productivity, lowers prices, reduces government budget deficits, and strengthens the Canadian dollar in relation to its U.S. counterpart. Most of the stimulus to the economy comes from growth in consumer expenditures and investment, due to lower production costs and improvements in real incomes.

Free trade will also help to facilitate the necessary structural adjustments - the shift away from labour-intensive industries to high-technology ones - in order for Canada to compete much more vigorously on world markets in the 1990s and beyond.

IMPACT BY SECTOR

While the direct effects of trade liberalization adversely affect Canadian industries that are highly protected - chiefly in the manufacturing sector - all industries benefit indirectly from the overall increase in consumer expenditures and investment (stimulated by cheaper U.S. imports). In the first scenario, the total net impact (direct plus indirect) of bilateral free trade on output and employment is positive and significant in 29 of the 36 industries examined. In the second scenario, 30 industries record gains in output and employment.

Primary industries such as forestry, agriculture, and fishing would benefit greatly from the removal of nontariff barriers. In the service sector, four industries - retail trade; wholesale trade; business services; and personal services - would account for close to 65 per cent of all new jobs. The substantial gains in service sector output and employment reflect the growing importance of services in the modern Canadian economy. All seven industries that would experience a decline in output and employment are in the manufacturing sector: rubber and plastics; leather; textiles; knitting mills; electrical products; chemical products; and miscellaneous manufacturing. These industries are highly protected and already face still competition from low-wage

developing countries. The net reduction in employment in these industries is about 16,000 in the first scenario, and less than 7,000 in the second. Overall, the manufacturing sector would benefit significantly from trade liberalization, with more than 42,000 jobs being created in this sector.

REGIONAL IMPACTS

To the extent that employment losses are concentrated in depressed regions and single-industry communities, free trade would exacerbate the adjustment problems in these areas. By increasing overall incomes and employment in Canada, however, free trade would also strengthen governments' fiscal ability to provide adjustment assistance. Moreover, the simulation results show that the gains from free trade would be relatively evenly distributed across all provinces. The Atlantic provinces, Alberta, and British Columbia would experience slightly above-average gains in output and employment, reflecting the relatively large importance of primary industries and construction in these provinces. Quebec and Ontario would bear most of the adjustment costs (about 90 per cent) because of the high concentration of manufacturing industries in these provinces (they account for about 75 per cent of total manufacturing output in Canada). At the same time, these provinces would also receive the lion's share of the total benefits (about 60 per cent).

In summary, our simulation results suggest that bilateral free trade with the United States would provide significant overall benefits to Canada, and that virtually all consuming and producing sectors in all provinces would share in these gains. The size of the impact depends upon the nature of free trade implicit in the assumptions, and the structure and properties of the models used to simulate these impacts. What is important is the character of the results, which strongly suggest that Canada-U.S. free trade will provide significant benefits to all Canadians. The last section of the paper describes the factors that could increase or decrease the size of the effects reported here. It concludes that the impacts are not biased in one direction or another.

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FOREWORD

This paper is one of the outputs from the Council's study of Trade Policy Options and Structural Adjustments in Canada. The objective of this study is to determine the effect of bilateral trade liberalization with the United States upon output and employment by industry and province, and upon the inflow and outflow of foreign direct investments of American and Canadian multinationals. In addition, the study will examine the nature and magnitude of adjustment pressures business firms and workers will face from bilateral trade liberalization and the way the economy will adapt to a new trading environment. The results from this research work will be published in 1988 in a Council research report and consensus statement. In addition, the Council will be commenting on some of the other issues relevant to the current Canada-U.S. negotiations in its forthcoming Annual Review.

Council researchers have completed the work on measuring the impact of Canada-U.S. free trade on output and employment for 36 industrial sectors and for the ten provinces. In light of the current bilateral trade negotiations, it is important to make this research available immediately to the public, although it has not been endorsed by members of the Council. Therefore, this discussion paper, by analysing the impact of a hypothetical comprehensive trade accord with the United States, determines which industries and regions will be the winners and losers from bilateral free trade, and how much the adjustment pressures are expected to be. The main conclusion emerging from this empirical analysis is that a Canada-U.S. free trade accord would provide significant overall benefits to Canada, and virtually all consuming and producing sectors in all provinces would share in these gains. Bilateral free trade would increase net output and employment both nationally and provincially, and incur fairly modest adjustment costs. One important qualification must, however, be made here about economic models. It is true that the size of the impact is influenced by the structure and properties of the economic models used to simulate the impact of free trade. What is important, however, is the character of the results, which strongly suggest that a comprehensive bilateral free trade agreement with the United States will provide significant economic benefits to all Canadians.

Judith Maxwell
Chairman

August 1987

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SECTION I

INTRODUCTION

With exports accounting for more than 30 per cent of Canada's Gross Domestic Product (GDP), it is clear that international trade is vital to the Canadian economy. Most important of all is Canada's trade with the United States, which has steadily increased, in spite of past efforts to diversify markets, from 66 per cent of total Canadian trade in 1981 to more than 75 per cent today. Clearly a stable and liberal international trading regime, especially in relation to the U.S., is crucial to Canada's continuing prosperity.

The recent slowdown in world trade reflects, to a large extent, structural changes and weaknesses in the world economy. Record trade and budget deficits in the United States, debt crises in key developing countries, high unemployment in Europe and Canada, and resistance to structural changes both in developed and under-developed countries have greatly increased protectionist pressures world wide. Among other things, these pressures have created a general climate of uncertainty which has inhibited business decisions and long-range planning, both in Canada and elsewhere.[1]

Rising protectionism in the United States and the associated increase in U.S. non-tariff barriers (Contingency Protection) is

threatening markets for many Canadian products, causing great anxiety within the Canadian business community. Concerns about Canada's access to the U.S. market and the great uncertainty about the outcome of current GATT negotiations have increased many Canadians' desire to put Canadian-American commercial relations on a sounder footing and to further Canada-United States trade liberalization. Similarly, the United States would like to improve and secure its access to the Canadian market through bilateral free trade negotiations. Even though American dependence on the Canadian market is relatively small, Canada is that country's largest trading partner, accounting for about 25 per cent of its trade in 1985. The United States also hopes that a comprehensive Canada-U.S. free trade agreement will stimulate progress toward wider trade liberalization under multilateral trade negotiations.[2]

The Economic Council of Canada in several earlier publications has called for greater trade liberalization as a way to improve the working of Canadian markets and enhance Canadian living standards.[3] The arguments for freer trade are well known and well established. The basic case for free trade remains the same as that formulated two centuries ago by Adam Smith and David Ricardo: the law of comparative advantage. The theory of comparative advantage says that nations will specialize in producing those goods for which they were best fitted and that trade liberalization will produce benefits to all the parties concerned (a positive sum game), because of differences in relative costs of

production. It benefits nations to produce domestically the goods in which they are relatively more efficient and import those in which they are relatively less efficient. Essentially, free trade will encourage international specialization and provide a wide array of goods and services from which to choose at lower real costs to consumers and producers than would be the case if everything were produced at home.

There are other economic arguments for freer trade. It is commonly argued that a country with a relatively small market such as Canada will benefit much more from liberalized trade through realization of scale economies than will a country with a large market. Free trade, by granting secure access to the large U.S. market and by permitting Canadian companies to take advantage of scale economies from larger plants and longer production runs, would thus improve total factor productivity and lead to lower unit production costs and a higher standard of living in Canada. By promoting competition, free trade will also reduce wage-price rigidities and improve the output-inflation trade-off. The incentive to adopt new technology and the pressure to achieve higher efficiency generally are greater if an industry is exposed to the rigours of international competition.[4]

However, bilateral Canada-U.S. free trade could hurt some firms and industries whose current costs are higher than those of their American counterparts. Confronted by new competition, some of these firms will not successfully adjust and would not survive.

Business dislocations and changes in jobs will almost certainly be part of the adjustment during a transitional period. Many firms could face strong adjustment pressures as they adapt to the larger North American market. Many Canadian plants would undergo adjustment by rationalizing through mergers or takeovers, by designing better or new products, by finding market niches, or by folding. But these adjustment costs have to be weighed against the gains from free trade. Because free trade provides net gains in output, employment, and real income, it should be possible to devise programs which will channel some of these gains to assist firms and employees facing transitional adjustment problems. Such programs are generally called adjustment policies, and they can be aimed in two directions - to cushion those negatively affected and to assist those who need help in gearing up for new opportunities.

But in order to devise appropriate adjustment policies, government must know which industries and regions will be the winners and losers from a bilateral free trade agreement. The primary objective of this paper, therefore, is to find out, in quantitative terms, just who these winners and losers are likely to be, and how big the adjustment pressures are expected to be. Using the estimates of trade barriers and the potential gains in manufacturing productivity through scale economies and rationalization, we will simulate the impact of a hypothetical Canada-U.S. free trade agreement on output and employment for 36 industrial sectors and for the ten provinces, with the help of

three models: the CANDIDE Model 3.0, the Statistics Canada Input-Output Model of the Canadian economy, and the provincial distribution of output and employment by province implicit in the Statistics Canada Regional Input-Output Model of the Canadian economy. The main conclusion emerging from our empirical analysis is that a Canada-U.S. free trade agreement would considerably increase net output and employment both nationally and provincially, incur fairly modest adjustment costs, and facilitate the necessary reallocation of resources from the sunset (labour-intensive) industries to the sunrise (high-tech) industries.

In the next Section 2, we describe an analytical framework for estimating the impact of Canada-U.S. free trade on the Canadian economy by industry and by province. In Section 3, we will discuss the assumptions made in regard to trade barriers in the two countries and likely productivity improvements in Canadian manufacturing due to Canada-U.S. free trade. In Section 4, we describe the design and the implementation of the free trade scenarios. In Section 5, we present the impact of these Canada-U.S. free trade scenarios on output and employment by industry and by province. In Section 6, we summarize the main results of our study and offer some concluding comments.

It should be noted at the outset that our focus here is on quantifying the purely economic impacts of a free trade agreement with the United States. Other Council documents, which will be released within the next few months, will deal with adjustment

policies and with social-political issues arising from bilateral free trade.

SECTION II

THE IMPACT OF TRADE LIBERALIZATION: METHODOLOGY

Canadian Literature on North American Free Trade

The current literature on the economic consequences of North American free trade is mainly Canadian in origin and focus. Most of this literature has suggested that there would be significant long term gains in output and real income for Canada from bilateral free trade with the United States.

A frequently cited estimate of the net gain accruing to Canada from a Canada-U.S. free trade agreement is the figure of 8.2 per cent in GNP put forward by Wonnacott (1975). Wonnacott assumes that in the event of free trade with the United States, Canadian manufacturing productivity would increase to U.S. levels. Using a figure of 27 per cent as the U.S. productivity advantage in manufacturing, he estimates that free trade would raise real Canadian GNP by (0.27) (0.22) = 5.9 per cent (where 0.22 is the 1973 ratio of value added in manufacturing to GNP). According to Wonnacott, the entire 27 per cent improvement in manufacturing productivity and the attendant 5.9 per cent rise in GNP would be due to greater scale economies and rationalization in Canadian manufacturing. An additional 2.3 per cent increase in GNP would result from improvements in resource allocation between sectors and the recapture of duty on Canadian exports previously paid to the U.S. Treasury.

More recent research by Harris and Cox (1984), using an applied general equilibrium model incorporating scale economies and imperfect competition, estimates that Canada would experience a 7 per cent increase in real GNP from bilateral free trade with the United States and an 8-10 per cent increase in GNP from multilateral free trade with the rest of the world. Harris and Cox also argue that the removal of world trade barriers would allow greater penetration of foreign markets, thereby leading to larger-scale production and lower average costs. In addition, removal of trade protection would promote competition domestically through the price mechanism, which would lead to further increases in the scale of production and still greater reductions in average costs.

The Harris and Cox estimates are considered to be biased upward.[5] They are at the upper end of the range of available estimates of the potential gains in GNP in Canada from Canada-U.S. free trade --- 1.3 to 7 per cent.[6] Nevertheless, the Harris-Cox study is a major contribution to the methodology of estimating the impacts of changes in trade policy, because of its innovative way of introducing elements of imperfect competition into the field of general equilibrium modelling.

Sources of the Gains from Free Trade

The mainstream view in Canada is that Canada-U.S. free trade offers the potential for increased real incomes and increased

trade to both countries.[7] But the size of such gains will depend on the relative impact of changes in several key factors. These include specialization, scale and rationalization, terms-of-trade, trade diversion, and the flexibility of both product and factor markets (which affects the magnitude and nature of the adjustment problem).[8]

Canada-U.S. free trade would increase real income in Canada by redistributing income shares toward the factors of production used extensively in exporting sectors. The pull exerted on factors toward tradable sectors depends in part on the relative rates of protection (tariffs and nontariff barriers) in these sectors prior to free trade. In addition to gains in efficiency due to improvements in resource allocation, removal of trade protection to domestic industries would reduce prices and increase real income by lowering the costs of imported goods to consumers as well as producers.

It has often been suggested that Canada's import restrictions have resulted in suboptimal plant size, short production runs, and excessive product diversity. As a result, it has been argued that Canadian manufacturing firms are on average substantially less efficient than their U.S. counterparts. For example, in 1986, Canadian manufacturing labour productivity (GDP per person-hour) was about 26 per pent below the comparable U.S. figure. As a result, it is believed that a Canada-U.S. trade agreement , by opening up a much larger market, will permit Canadian producers to

take advantage of scale economies and product specialization and induce a much-needed restructuring of Canadian manufacturing, by moving many suboptimal plants with high average costs to more efficient levels through mergers, takeovers, and increased specialization. The potential for gains in manufacturing productivity through scale economies and rationalization is a major argument in favor of trade liberalization in Canada. A detailed description of these potential gains appears in the next section.

Terms-of-trade (the ratio of the average export price to the average import price) and trade diversion effects are also important in quantifying the economic impact of bilateral free trade with the United States. Terms-of-trade gains (an increase in export prices relative to import prices) would enhance the country's gains in real income from free trade and vice versa.

Terms-of-trade changes depend critically on the relative importance of trade creation and import penetration effects associated with changes in the trade barriers in the two countries. Canada-U.S. free trade could either improve or worsen the terms-of-trade for Canada. If, in the United States, imports from Canada and domestic goods were perfect substitutes, U.S. consumers would respond to preferential reductions of tariffs and nontariff barriers by increasing consumption of Canadian products until the Canadian price was equal to the world price plus U.S. tariff protection. In this case, Canada would be allowed to

retain tariff revenues which would otherwise have been collected by the U.S. government, improving terms-of-trade for Canada. On the other hand, if Americans viewed Canadian and American goods as poor substitutes, the export penetration effect would be weak, resulting in a terms-of-trade loss for Canada. In addition, if Canadians viewed the two countries' goods as close substitutes, a stronger trade creation effect would worsen the terms-of-trade for Canada. The adverse terms-of-trade effect would be comparatively large if Canadian trade barriers on U.S. exports were larger on average than U.S. trade barriers on Canadian exports.

Canada-U.S. free trade could impose trade diversion costs on Canada, reducing the potential gains from free trade. These costs would occur because of the switch in Canadian imports from lower-cost third countries (such as Japan) to higher-cost U.S. imports, because the imports from the U.S. now come into Canada duty free, whereas the third country imports are still subject to duty. Under multilateral trade liberalization there would be no such trade diversion and thus no associated costs. In any event, since more than three-quarters of Canadian trade is currently conducted with the United States, the trade diversion costs from bilateral free trade with the United States are expected to be quite small for Canada.[9]

Estimating the Impact of Free Trade: Various Approaches

Three general approaches can be used to estimate the impact of Canada-U.S. free trade on the Canadian economy. These are input-output analysis, general equilibrium modelling, and macro-econometric modelling.

The simplest and least satisfactory approach is to use a closed input-output model to estimate the changes in output and employment by industry that would occur given an exogenously determined change in final demand.[10] This model is not capable of capturing the important effects of bilateral free trade in Canada from increased specialization, scale economies, and rationalization, or from terms-of-trade changes and trade diversion. It is also not capable of incorporating changes in wages, prices, exchange rate, and final demand, and their feedback effects on output and employment.

In the general equilibrium models, prices and outputs are explicitly calculated from supply and demand equations in each industry.[11] Consequently, these models are well suited to capture the long-term (equilibrium) changes in resource allocation and their impact on real income induced by changes in relative prices and costs. These models also capture fairly well the consequences of free-trade-induced changes in scale and rationalization, terms-of-trade, and trade diversion for real incomes. However, these models assume that unemployment is voluntary. Like the

input-output models, these models are not suitable for assessing the short- to medium-term consequences of trade policy changes in output, employment, the unemployment rate, the exchange rate and prices. As well, monetary variables do not play any role in the determination of final demand and the adjustment process.

In contrast, large scale disaggregated (sectoral) macro-econometric models such as the CANDIDE Model 3.0 can capture the short- to medium-term as well as the longer-range consequences of Canada-U.S. free trade for the Canadian economy.[12] Like the general equilibrium (GE) models, large-scale macro-econometric models can capture the allocation and terms-of-trade effects of bilateral free trade fairly well. While they are not well equipped to pick up the effects of scale economies and rationalization, these effects can be exogenously introduced into the model. For example, in simulating the economic impact of Canada-U.S. free trade in Canada, we have explicitly introduced industry-specific improvements in manufacturing productivity due to scale economies and rationalization, based on our review of the theoretical and empirical aspects of this important subject. We shall describe this procedure in some detail later on.

In summary, both general equilibrium and macro-econometric models have their strengths and weaknesses. General equilibrium models have a comparative edge over the macro-econometric models in capturing the long-run allocative and distributional consequences of Canada-U.S. free trade. On the other hand,

macro-econometric models are better suited to analyze the short-to medium-term consequences of changes in trade policy for output, employment, price level, interest rates, and the like. Unlike the GE models, macro-econometric models do not assume full employment in the short to medium term. Moreover, in macro-econometric models monetary variables play a role in the determination of final demand, the closing of the output gap, and the reduction of unemployment.

Our Research Strategy

Recognizing the complementary nature of the two types of models described above, the Council has decided to use both approaches for assessing the economic impact of bilateral free trade only with the United States. In this paper, we report the results of the CANDIDE Model 3.0 and Statistics Canada's Input-Output Model of the Canadian economy. Professors R. Muller and J. Williams of McMaster University will report on the general equilibrium model results in a separate paper.

In the 1986 Annual Review, the Council reported the simulated impact of a Canada-U.S. free trade agreement on aggregate output and employment in Canada using CANDIDE Model 3.0. These simulation results indicated that bilateral free trade with the United States would result in a significant increase in Canadian real GNP (Gross National Product), particularly if wider market opportunities were accompanied by domestic productivity improvements.

Over the last ten months or so, we have done considerable new work in this area. In particular, we have developed new and more up-to-date estimates of trade protection (tariffs and nontariff barriers) in Canada and the U.S. We have also examined the relationship between productivity improvement and trade enhancement. In contrast to last year's global assumption of a 5 per cent increase in total factor productivity in the manufacturing sector, we have now prepared industry-specific estimates of potential gains in total factor productivity due to scale economies and rationalization for the twenty Canadian manufacturing industries (at the two-digit level).

Using this new data on trade barriers and productivity improvements, we have simulated the aggregate effects of bilateral free trade on output, employment, prices, exchange rates, and various other indicators using the CANDIDE Model 3.0. To obtain accurate estimates of industry and regional impacts of Canada-U.S. free trade, good estimates of the direct effects of free trade on exports and imports and their consequences for output and employment by industry are vital. Using the new disaggregated data on commodity-specific trade barriers in the two countries and trade elasticities from the University of Maryland Model, changes in exports and imports by commodity are computed. These <u>direct effects</u> of free trade on net exports are in turn translated into changes in output and employment by industry and by province using the Statistics Canada Input-Output Model of the Canadian economy. Long-term (1995) changes in final demand (level and composition)

from the CANDIDE simulations are translated into indirect effects on output and employment by industry and by province, using the Statistics Canada National Input-Output Model. The sum of direct and indirect effects (total effects) by industry is obtained to add up to the CANDIDE aggregate effects in 1995. A detailed description of the procedures used to link the two models is given in Table 1 and Appendix B-1. These industry effects are then translated into provincial impacts by industry, using the 1979 market shares implicit in the Statistics Canada Regional Input-Output Model of the Canadian economy.

Working of Trade Policy in CANDIDE Model 3.0

Before we discuss assumptions, the design of the Canada-U.S. free trade policy scenarios, and the simulation results, we should briefly describe the structure and working of the CANDIDE Model 3.0.

CANDIDE Model 3.0 is a large disaggregated annual macro-econometric model of the Canadian economy, estimated using time-series data from 1954-81. It contains 2,390 endogenous variables, with 825 stochastic equations. It uses about 1,050 exogenous inputs (fiscal and monetary policy variables, demographic variables, energy prices and energy investment, and external environment inputs and trade prices, etc.). It can be viewed as a collection of 44 well-articulated industry models, carefully interfaced with a traditional neo-Keynesian

Table 1

Linking CANDIDE Model 3.0 with the Statistics Canada Input-Output (I/0) Model: Canada-U.S. Free Trade Simulations

Objectives:
1) Statistics Canada National Input-Output Model is used to obtain sufficient industry disaggregation. The direct effects of Canada-U.S. free trade on net exports by 69 commodities are translated into changes in output and employment by industry using the I/0 Model.
2) On the other hand, indirect effects of Canada-U.S. free trade on consumer expenditure, investment, government expenditure on goods and services and inventory change are captured well by the CANDIDE Model. These changes in final demand (excluding net exports) are passed through the I/0 Model to obtain the indirect effects of Canada-U.S. free trade on output and employment by industry in Canada. The sum of direct and indirect effects gives the total effect by I/0 industry.

Simulation 1	Step 1	Step 2	Step 3
Removal of trade barriers (tariffs, and NTBs and federal government discriminatory procurement policies) in two countries.	Direct effects by I/0 industry: Using the information on percent changes in export and import prices (due to the removal of trade barriers), import and export price elasticities and the base case volume of exports and imports (1995), changes in exports and imports by 69 commodities are computed. These changes in net exports are in turn converted into changes in output and employment by I/0 industry.	Indirect effects by I/0 industry: The impact of Canada-U.S. free trade on final demand by commodities (excluding exports and imports) from the CANDIDE Simulation (1995) are passed through the I/0 Model to obtain the indirect effects on output and employment by industry.	Total effects by I/0 industry: These are computed by summing the direct and the indirect effects.
Simulation 2	**Step 1**	**Step 2**	**Step 3**
Removal of trade barriers in the two countries plus improvements in manufacturing productivity due to scale economies and rationalization.	Direct effects by I/0 industry: Using the information on percent changes in export and import prices (due to the removal of trade barriers), import and export price elasticities and the base case volume of exports and imports (1995), changes in exports and imports by 69 commodities are computed. These changes in net exports are in turn converted into changes in output and employment by I/0 industry.	Indirect effects of Canada-U.S. free trade on final demand from Simulation 2 (excluding net exports), from the CANDIDE Model (1995), are passed through the I-0 Model to obtain the indirect effects on output and employment by I/0 industry.	The sum of direct and indirect effects by I/0 industry gives the total effect by I/0 industry.

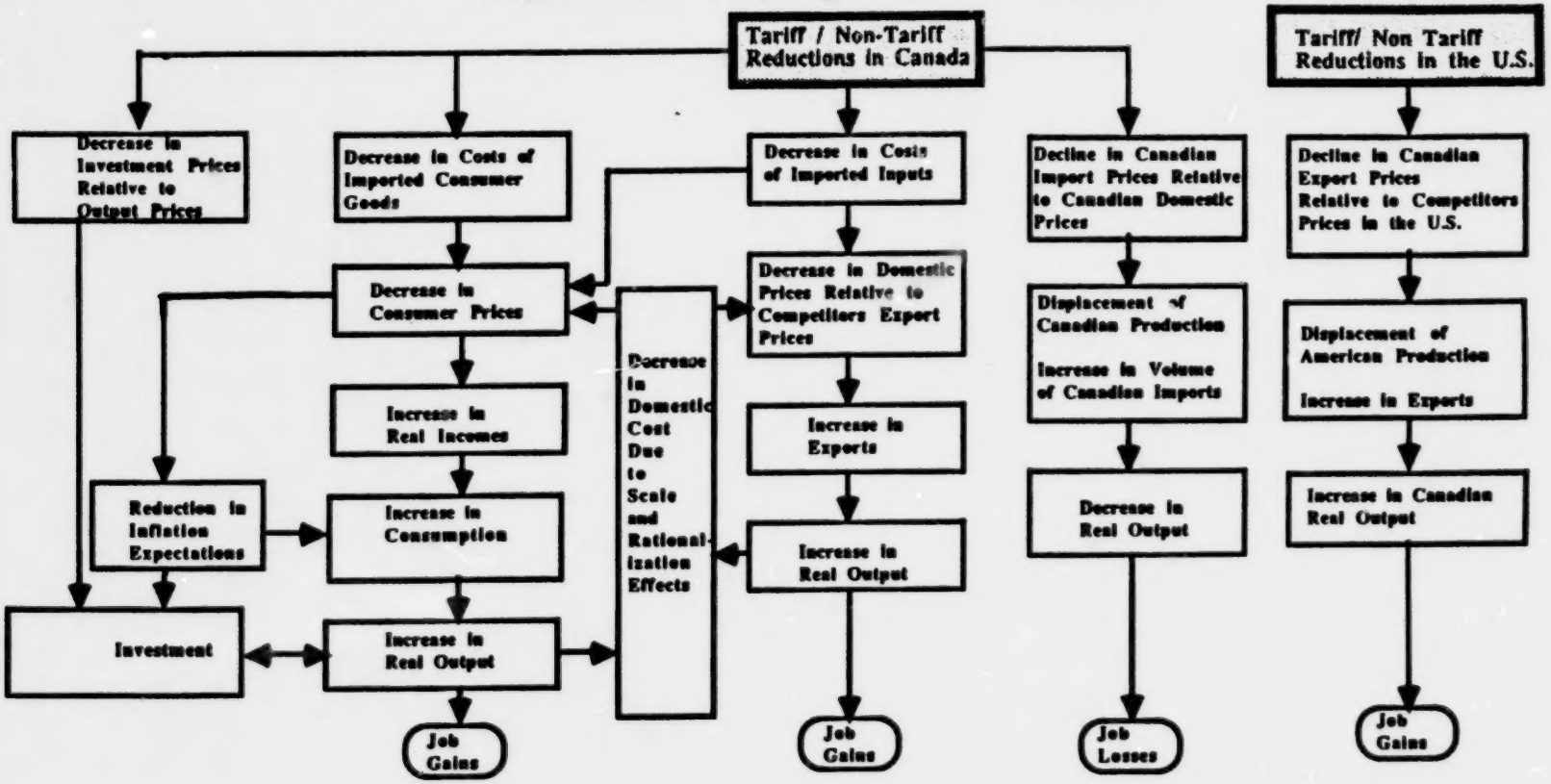
macro-econometric model. Even though the CANDIDE Model 3.0 is based on the well-known IS-LM framework, it incorporates most of the recent developments in macro-economics, including government budget constraints, expectations, reaction functions, flexible exchange rates, crowding-out, the vertical Phillips curve, supply constraints, and the like. Its dynamic responses to standard monetary and fiscal shocks are in line with the properties of other well developed macro-econometric models of the Canadian economy.[13]

To provide a clearer understanding of the structure of this mammoth model, a 55-equation outline is given in Appendix A. This representation captures the major structural and behavioural relationships, abstracting the sector disaggregation incorporated in the model.

We will now briefly describe the working of trade policy changes in CANDIDE Model 3-0 under the flexible exchange rate system. Removal of trade barriers in the two countries increases both exports and imports (see Chart 1). Of course, the effect on net exports critically depends on the relative size of trade barriers in the two countries and the responsiveness of exports and imports to changes in relative prices, operating through import and export prices. Removal of tariffs and nontariff barriers in Canada would reduce the cost of imports to consumers, resulting in increased real incomes to Canadians. However, tax increases to recover the lost tariff revenue would offset some of the stimulus to consumer

CHART 1

Effects of Canada-U.S. Free Trade on Output and Employment in Canada


Tariff / Non-Tariff Reductions in Canada
Tariff/ Non Tariff Reductions in the U.S.
Decrease in Investment Prices Relative to Output Prices
Decrease in Costs of Imported Consumer Goods
Decrease in Costs of Imported Inputs
Decline in Canadian Import Prices Relative to Canadian Domestic Prices
Decline in Canadian Export Prices Relative to Competitors Prices in the U.S.
Decrease in Consumer Prices
Decrease in Domestic Prices Relative to Competitors Export Prices
Displacement of Canadian Production
Increase in Volume of Canadian Imports
Displacement of American Production
Increase in Exports
Increase in Real Incomes
Decrease in Domestic Cost Due to Scale and Rationalization Effects
Increase in Exports
Reduction in Inflation Expectations
Increase in Consumption
Increase in Real Output
Decrease in Real Output
Increase in Canadian Real Output
Investment
Increase in Real Output
Job Gains
Job Gains
Job Losses
Job Gains

expenditure. On the other hand, business investment expenditure would increase over time in response to positive changes in output and capacity utilization. Since a large part of Canadian machinery and equipment is imported, the removal of trade barriers would reduce the average price of investment goods relative to the output price, further stimulating business investment.

Reductions in consumer prices and in the costs of imported intermediate inputs would set in motion a "virtuous cycle" of lower prices, working through the wage-price-exchange rate (appreciation) nexus, and resulting in a significant reduction in sector prices in the medium to long-term. Consumer expenditures and net exports would also react favourably to price reductions. Since fewer savings would be required to maintain the real value of financial assets, lower inflation would reduce the personal savings rate directly, giving a further boost to consumer expenditures.

Changes in relative prices also induce changes in the allocation of resources among sectors, resulting in productivity improvements. Increases in consumer expenditure and investment are translated into increases in sector outputs. In the short run, most of the increases in output are translated into improvements in productivity. Over time, however, increases in output lead, as well, to increases in employment. In addition, the labour supply would increase in response to increases in real wages and improved employment opportunities in the economy.

In summary, in the CANDIDE Model, removal of trade barriers in the two countries will increase two-way trade, lower intlation, increase the value of the Canadian dollar vis-à-vis its U.S. counterpart, improve real incomes, stimulate consumer expenditure and business investment, and increase output and employment in Canada. We turn now to the key assumptions used to quantify these effects.

SECTION III

MAJOR ASSUMPTIONS

The level and structure of trade protection (tariffs, nontariff barriers, and discriminatory government procurement policies) in the two countries, assumptions about monetary and fiscal policies, the pricing behaviour of domestic firms, potential gains in manufacturing productivity due to scale economies and rationalization, and business investment (especially foreign direct investment) all play a major role in determining the likely economic impact of bilateral free trade on Canada.

In the previous section we briefly described both the structure and the working of CANDIDE Model 3.0. Before we proceed with the description of free trade scenarios and the presentation of simulation results, we need to know what existing trade barriers are in the two countries. We shall also present some estimates of potential (industry specific) productivity gains in Canadian manufacturing, due to free-trade induced scale economies and rationalization.

In this section, we first present estimates of tariffs, tariff equivalents of standard NTBs to trade in goods between Canada and the United States (these include quotas, voluntary export restrictions, countervailing duties, anti-dumping safeguards, health and safety standards, supply management and import

licensing), and the impact of discriminatory government procurement policies in the two countries on both exports and imports. Finally, after examining the level and structure of Canadian and American subsidies and their distortionary effects on trade and output, we summarize our research findings on the Canada-U.S. productivity gap and the role free trade can play in closing this gap.

Tariff Rates

Tariffs in the major industrialized countries have been reduced to relatively low rates as a consequence of the Tokyo Round and the preceding rounds of multilateral negotiations. For example, the average Canadian tariff rate will decline from its pre-Tokyo Round value of 6.0 per cent to 3.8 per cent in 1987 (the last year of Tokyo Round reductions), a decline of more than one-third. American tariff rates will decline by a similar proportion.

Table 2 shows the level and the structure of post-Tokyo Round tariff protection in the two countries. In all sectors (except tobacco, wood, and fishing and trapping), Canadian tariff rates are significantly higher than their U.S. counterparts. The average Canadian tariff rate on goods is about 3.8 per cent (11.2 per cent on dutiable goods), compared to 2.3 per cent in the United States (6.5 per cent on the dutiable goods).

However, the structure of tariff protection is very similar in the two countries: industries that are highly protected in Canada

Table 2

Comparison of Canadian and U.S. Trade Barriers

Industry	Canada		United States	
	Tariff rate	NTBs (tariff equivalent)	Tariff rate	NTBs (tariff equivalent)
	(Per cent)			
Agriculture	2.2	11.9	2.2	6.9
Forestry	0.0	0.1	0.2	0.2
Fishing and trapping	0.2	0.0	1.4	0.0
Metal mines	0.1	0.0	0.2	0.0
Mineral fuels	0.4	0.0	0.3	0.0
Non-metal mines and quarries	0.5	0.0	0.1	0.4
Food and beverage	4.2	9.0	3.5	8.5
Tobacco	16.0	0.0	10.1	0.6
Rubber and plastics	8.9	0.0	8.4	0.4
Leather	12.0	4.2	7.9	0.0
Textiles	8.9	0.0	7.3	0.4
Knitting mills	21.5	0.0	12.6	0.4
Clothing	17.2	0.0	10.7	0.4
Wood	2.7	0.0	1.4	12.9
Furniture and fixtures	12.6	0.0	3.0	0.8
Paper and allied products	4.0	0.0	0.9	0.3
Printing and publishing	1.4	0.8	0.5	0.2
Primary metals	4.0	1.3	2.2	4.2
Metal fabricating	6.8	0.9	3.2	1.0
Machinery	4.7	0.9	2.5	3.0
Transportation and equipment	2.3	0.0	0.5	0.0
Electrical products	6.1	0.9	3.7	0.1
Non-metallic mineral products	3.4	0.0	2.9	0.0
Petroleum and coal products	0.5	0.0	0.4	0.0
Chemicals and chemical products	5.6	0.0	2.2	1.2
Misc. manufacturing	6.2	0.9	3.5	0.2
Goods producing	3.8	1.0	2.3	1.8

Sources: Estimates by the Economic Council of Canada (see Appendix B). Estimates of NTBs (tariff equivalents) are based on Lodh and Magun (1987).

are, for the most part, also highly protected in the United States. In both countries, tariff protection is much greater for manufactured goods than nonmanufactured goods (primary industries). Within manufacturing, tariff rates are relatively high on labour-intensive products such as tobacco, rubber and plastics, leather, textiles, knitting mills, and clothing, and relatively low on semi-durable and durable manufacturing products (except furniture and tixtures in Canada and wood products in the United States).

Bilateral tariff elimination would have a greater overall economic impact on Canada than the Tokyo Round tariff reductions for two reasons: tariffs are higher in Canada and the U.S. market accounts for a greater share of Canadian trade. Bilateral free trade would reduce the average Canadian tariff rate by over 3.0 percentage points, compared to the 2.2-point reduction of the Tokyo Round. Moreover, the impact on highly-protected industries could be even greater since the Tokyo Round tariff reductions for these industries were proportionately smaller than the average reduction. Similarly, tariff barriers to Canadian exports would decline substantially more than they did after the Tokyo Round. Therefore, bilateral tariff elimination would likely lead to a significant increase in the trade in manufactured goods between the two countries.

Nontariff Barriers

It is widely acknowledged that there has recently been a dramatic increase in protectionist sentiment both in the United States and elsewhere. Since the mid-1970s, in response to import-competing sectors' difficulties in adjusting to changes in long-term comparative advantage and a generally more troubled international economic climate, national governments have increasingly used trade policies to improve their competitive domestic situation and to respond to internal political pressures. Because of GATT obligations which "bind" lower tariffs, protection has taken other forms, including voluntary export restraints on supplier countries (VER), orderly marketing agreements (OMA), contingency protection (countervails, safeguards, and anti-dumping), subsidies, discriminatory government procurement policies, and the like.

Both Canada and the United States make use of contingency mechanisms to protect domestic producers from "unfair" competition from imports. Recently, the U.S. has intensified its use of trade laws to impose contingency protection against Canada and other countries. A brief description of the recent trade actions (1984-86) taken by the U.S. against Canada and by Canada against the U.S. is shown in Tables 3 and 4. All but one of the Canadian actions involved anti-dumping, while U.S. actions were evenly divided among countervail, anti-dumping, and safeguards. The U.S. actions fell primarily on resource-based exports, while Canadian

Table 3

Recent U.S. Trade Actions Against Canada*

		Approx. Duty
		(Per cent)
	Anti-Dumping Cases	
1.	Carnation	15-20
2.	Man-Made Covers	6.7-20
3.	Brass Steel & Strips	In progress
4.	Gas and Oil well Steel Products (Oil country)	19
5.	Oil Country Tubular Goods (only IPSCO)	0.7
6.	Dried Salted Codfish	20.75
	Countervails	
7.	Hogs	20.5
8.	Atlantic Groundfish	5-8
9.	Softwood Lumber	15
	Others (by type of restrictions)	
10.	West Coast Salmon (unfair trade practices)	U.S. may withdraw
11.	Carbon Steel Pipes and Tubes (voluntary export restraint)	-
12.	Shakes and Shingles (escape clause or safeguards)	35
13.	Speciality Steel (quotas)	-
14.	Sugars & Syrups (quotas)	-
15.	Women and Girls Footwear (global quotas)	-
16.	Beef and Veal (global quotas)	-
17.	Millfeed Exports to U.S. Pacific Northwest (voluntary export restraint)	-
18.	All Products (special import surcharge)	0.22 (in 1987) 0.17 (in 1988-89)

* In effect as of December 1986.

Source: a) Department of External Affairs
b) U.S. ITC publications (Annual Reports)
c) Rugman (1987)

Table 4

Recent Canadian Trade Actions Against the U.S.*

		Approx. Margin of Duty
		(Per cent)
Anti-Dumping Cases		
1.	Charcoal Briquets	60
2.	Abrasion Resistant Steel Pipe	18
3.	Commercial Grade Sodium Carbonate	2
4.	Cutting and Greasing Steel Rules	22.9
5.	High Voltage Porcelain Insulation	13.56
6.	Industrial Wood Cutting Band Saw Blades	36.2
7.	Integral Horse Power Induction Motors	12.0
8.	Oil Country Tubular Goods	3.7
9.	Photo Albums with Self-Adhesive Leaves	14
10.	Plate Coils	17.8
11.	Stainless Steel, Nickel and Nickel Alloy Pipe (for aircraft production)	28.4
12.	Surgical Gloves	N.A.
13.	Vehicle Washing Equipment	Up to 52
14.	Potatoes	23
Countervails		
15.	Grain Corn	65 per cent or U.S. $1.048 per bushel

N.A.: Not available.
* In effect as of December 1986.

Margin of Duty is the ratio of the difference between normal value and export price to normal value. Data obtained from case studies from Revenue Canada and annual reports of the Canadian Import Tribunal.

Source: a) Canadian Import Tribunal, Annual Reports.
b) Revenue Canada, Case Studies (unpublished).

actions were directed against a large number of manufactured imports from the United States, with the sole exception of the first countervail action on grain corn.

Based on 1984 trade data, U.S. trade actions affected $5.3 billion Canadian exports to the U.S. or 5 per cent of total Canadian merchandise exports to the U.S. In contrast, Canadian coverage of protection of U.S. exports was only $215 million or 0.2 per cent of U.S. merchandise exports to Canada. A large part of the difference can be attributed to the countervailing duty on softwood lumber, which affects close to $3.5 billion worth of Canadian exports to the U.S.[14] The possible long-term adverse effects of both existing and potential U.S. contingency actions are major concerns for Canada.

These measures of the coverage of NTBs do not reveal the trade actions' restictiveness in terms of their impact on exports and imports. For this purpose, what is needed are the price-increasing or quantity-reducing effects of the NTBs (tariff equivalents). Furthermore, the above-mentioned trade actions do not cover all the other NTBs, such as prohibition, import licensing, custom valuation, safety standards, and other quotas, that have been in effect for a long time in Canada and the United States.

To estimate the trade flow distortions of the NTBs in the two countries, we have computed their tariff equivalents.[15] Our

measures capture the effects of contingency protection, voluntary export restraints, prohibition (health and safety standards), import licensing, and discretionary custom valuation in the two countries.

The estimates of NTBs (tariff equivalents) in the two countries (by industry) are shown in Table 2. In Canada, NTBs are concentrated in agriculture (11.9%), food and beverages (9.0%) (primarily meat and dairy products), and leather industries (4.2%). Canadian NTB rates (tariff equivalents) vary from a low of 0.1 per cent for forestry to a high of 11.9 per cent in agriculture. The U.S. NTBs vary from as low as 0.1 percent on electrical products to a high of 12.9 per cent in the wood industry. Unlike tariffs, NTBs (tariff equivalents), on average, are higher in the United States than in Canada. In the U.S. they average 1.8 per cent of the value of total trade, compared to 1.0 per cent in Canada.

As in the case of tariff rates, the structure of NTB protection is similar in the two countries. In the United States, NTBs are also concentrated in agriculture (6.9%) and food and beverages (8.5%). But, unlike Canada, the United States has substantial NTBs in the wood (12.9%) and primary metal (4.2%) industries. By contrast, there are no American NTBs on leather products.

Federal Government Procurement Policies

Despite the GATT Procurement Code, government purchasing policies are often used to restrict imports in a number of ways, including preferential treatment of domestically-produced over foreign-produced goods, domestic content rules, single source contracting, domestic set-asides, (e.g., preference for small business), lack of documentation of tenders, national security considerations, and the like.

The GATT Agreement on government procurement is limited. For example, it does not cover provinces or states, federally-funded programs undertaken by other levels of government, Crown Corporations, R&D, domestic set-asides, or service contracts. Defence goods purchases are also not covered by the GATT Code, except for bilateral agreements such as the Canada-U.S. Defence Sharing Agreement.

Estimating trade distortions due to government discriminatory policies is difficult, because of the lack of consistent sets of data by commodity across countries. Thus, we have limited our investigation to federal government purchases of goods in the two countries.

The impact of government imports resulting from discriminatory procurement policies may be estimated by assuming that the observed difference between federal government and private sector

import propensities is entirely caused by discrimination between domestic and foreign suppliers (see Appendix B-4). This approach is often used because direct evidence of tariff equivalents by price-comparison methods cannot be easily obtained across commodities and countries. This method implicitly assumes that the public sector, like the private sector, should try to minimize its operating costs by buying its supplies from the cheapest source, subject to quality control.[16]

The size of federal government procurement in goods and services in the two countries for the 1984 fiscal year is shown in Table 5. The total purchases of goods by the U.S. government were more than 15 times that of the Canadian government in the 1984-85 fiscal year. To be sure, the services' share of total U.S. procurement is relatively large (46 per cent) compared to Canada (29 per cent). Nevertheless, the huge absolute difference in federal government procurement of goods in the two countries suggests significant potential for increased Canadian exports to the U.S. from liberalization of federal government procurement policies in the United States and Canada.

Following the procedure described in Appendix B-4, we have computed the detrimental impact of federal government procurement policies on imports by commodity in the two countries (see Table 6). Our calculations suggest that a bilateral free trade agreement on federal government procurement of goods could increase Canada's net exports by $800 million (1984 prices). Most

Table 5

Federal Government Procurement: Aggregates
Canada-U.S., 1984

(Billions of dollars)
(Percentages in brackets)

Category	Canadian Procurement - Canadian$				U.S. Procurement - U.S.$			
	Total		Imports from U.S.		Total		Imports from Canada	
	(1)		(2)		(3)		(4)	
		% of total		% of col. 1		% of total		% of col. 3
Federal purchase (goods)	5.44	(71)	1.09	(20)	90.77	(54)	.43	(.47)
a) Defence	3.19	(42)	1.04	(32.6)	83.90	(50)	.36	(.43)
b) Nondefence	2.25	(29)	.05	(2.2)	6.87	(4)	.06	(0.9)
Federal purchase (services)	2.2	(29)	.075	(3.4)	76.9	(46)	.14	(.18)
Total goods/services	7.64	(100)	1.165	(15)	167.7	(100)	.57	(.34)

N.B. Percentages of imports in cols (2) and (4) are simply imports divided by actual purchases in a category. Imports here are classified as direct imports only. No indirect imports are available on a consistent basis.

Source: Department of Supply and Services, Government of Canada, 1986.

Table 6

Federal Government Procurement: Imports Replaced by Current Policies, Canada-U.S., (1984)
(in millions of 1984 Canadian $, goods sector only)

Commodity	Canada	U.S.
Grains		
Live Animals		
Other Agricultural Products		
Forestry Products		
Fish Landings		
Hunting and Trapping Products		
Iron Ores and Concentrates		
Other Metal Ores and Concentrates		
Coal		
Crude Mineral Oils		
Natural Gas		
Non-metallic Minerals		49
Services Incidental to Mining		
Meat Products	1.5	7
Dairy Products		
Fish Products		
Fruits and Vegetables Preparations	3.8	2.7
Feeds		
Flour, Wheat, Meal and Other Cereals		
Breakfast Cereal and Bakery Products	1	1.1
Sugar		
Miscellaneous Food Products	5.0	1.6
Soft Drinks		
Alcoholic Beverages		
Tobacco Processed Unmanufactured		
Cigarettes and Tobacco Manufactured		
Tires and Tubes	2.0	1.4
Other Rubber Products	3.0	
Plastic Fabricated Products		
Leather and Leather Products		
Yarns and Man Made Fibres		
Fabrics	2.3	2.4
Other Textile Products	3.7	
Hosiery and Knitted Wear		
Clothing and Accessories		
Lumber and Timber		
Veneer and Plywood	2.5	1.0
Other Wood Fabricated Materials		
Furniture and Fixtures	5.2	3.8
Pulp		
Newsprint and Other Paper Stock		
Paper Products	5.7	10

Table 6 (Cont'd)

Federal Government Procurement: Imports Replaced by Current Policies, Canada-U.S., (1984)
(in millions of 1984 Canadian $, goods sector only)

Commodity	Canada	U.S.
Printing and Publishing		
Advertising, Print Media		
Iron and Steel Products		
Aluminum Products		
Copper and Copper Alloy Products		
Nickel Products		
Other Non-ferrous Metal Products	2.2	2.6
Boilers, Tanks and Plates	2.0	
Fabricated Structural Metal Products		
Other Metal Fabricated Products	4.8	57
Agricultural Machinery	6.4	
Other Industrial Machinery	114	11
Motor Vehicles	77	
Motor Vehicle Parts	11	87
Other Transport Equipment	244	1104
Appliances and Receivers, Household		
Other Electrical Products	119	16.8
Cement and Concrete Products		
Other Non-metallic Mineral Products		
Gasoline and Fuel Oil	8.2	
Other Petroleum and Coal Products	2.4	
Industrial Chemicals	2.5	
Fertilizers		
Pharmaceuticals		
Other Chemical Products		298
Scientific Equipment	345	
Other Manufactured Products		3.2
Sub-total	974.2	1711.6
Rest (sum of rest of commodities)	15.8	82.4
Total	990	1794

Source Lodh and Magun (1987).

of the $1.8 billion gross increase in Canadian exports would be concentrated in other transportation equipment (ships, boats, small aircraft, military trucks, etc). At the same time, the United States would increase its exports to Canada by about $1.0 billion. Scientific equipment, other transportation equipment, industrial machinery, and motor vehicles would account for close to 80 per cent of the total increase in U.S. exports to Canada. It may be noted that these calculations relate to goods only. There will, of course, be further scope for expanding bilateral trade in services.

Subsidies

Subsidies represent one of the most difficult and complex sets of problems facing the world trading system today. The term "subsidy" generally refers to a government policy action that reduces a producer's costs of developing, producing, or distributing a product relative to the costs of other producers of that product. The other producers may be domestic or foreign companies. The subsidy program provides the subsidized producer with an artificial competitive advantage.

Subsidies lie at the heart of the fairness question. They are at the centre of disputes over trade in general, and agriculture and high technology, in particular. Subsidies create distortions in the volume and the composition of trade and production in the world economy. They also impose burdens on consumers and taxpayers, increase the inefficiency of resource allocation, and

create trade frictions in both exporting and importing countries. A majority of the trade disputes brought to the GATT recently have related to agricultural subsidies and agricultural export credits, which have provoked countervail actions in the importing countries.

To ensure that the use of subsidies did not adversely affect or prejudice the interests of any trading country, and that the use of countervailing measures did not create major trade frictions and impede international trade, the Tokyo Round created the subsidies and countervailing measures code. The main features of the code are that: (a) export subsidies on products other than primary products are forbidden; (b) internal (domestic) subsidies should be such as to avoid trade-distorting effects; (c) countervailing duties (CVD) may be imposed only if injury has been established to occur as a result of the subsidy; (d) export subsidies on primary commodities should not be used to obtain more than an equitable share of world trade; and (e) contracting parties are notified of all subsidies.[17]

Trade disputes over subsidies have drawn attention to the limitations of the GATT discipline. The subsidies and countervailing measures code is perceived to be working poorly, mainly because of differing interpretations of its provisions and disagreement on fundamental concepts.

Export subsidies, favouring exported products over goods sold on the home market, are generally prohibited by the subsidies Code,

but agricultural goods are generally exempt from the code. Not surprisingly, most GATT disputes have centered on export subsidies for agricultural sales. Furthermore, code provisions are ambiguous and weak against domestic subsidies, namely subsidies that make no distinction between goods sold abroad and goods sold at home. Recent trade disputes between the United States and the European Community have centered on the legality of subsidies on first-level processed agricultural products. The European Community feels that in signing the code it has not given up the right to subsidize these kinds of products.

A subsidy can take many forms, and the objectives of different subsidy programs can vary considerably. Such tactics as direct cash grants, tax breaks, tax credits, low-interest loans, or loan guarantees may, for example, be used to subsidize production costs, to locate in a specific community or region, or to undertake research and development.

Companies can also benefit from cost reductions through government regulations. For many years, the Canadian and U.S. governments have kept their domestic energy prices below the world price, providing domestic industries with a cost advantage over foreign producers paying world prices. Similarly, Western Canadian wheat farmers continue to benefit from lower rail transportation costs under the Western Grain Transportation Act.

Unlike tariffs, standard NTBs, and discriminatory government procurement policies, subsidies do not affect the price of imports

directly. Instead, they allow domestic producers either to set a price below that which would have prevailed in the absence of the subsidy, or to produce a higher quantity of output at market prices.

Domestic subsidies may not always distort a country's trade or production patterns. However, if subsidies are provided on a selective industry basis, then they can and do provide significant protection to domestic industries and are likely to result in distortions in the volume and composition of trade.

The following two approaches are often used to compute subsidy rates by industry: (a) the national accounts approach; and (b) the producer's subsidy equivalent (PSE) approach. The national accounts approach includes only direct payments to producers. Included in the estimates are all current government subsidies provided in the form of grants designed to subsidize income deficiencies, labour inputs, and transportation and other distribution costs. In contrast, the producer's subsidy equivalent approach includes all direct and indirect payments to producers. Indirect subsidies include transportation subsidies, fertilizer subsidies, tax relief, low-interest loans, lower insurance costs, lower energy prices, loan guarantees, and others.

To assess the importance of subsidies in Canada and the United States, we have developed estimates of subsidy rates by commodity

for the two countries using the PSE. It is calculated as a ratio of the value of all subsidies (direct and indirect) to the total value earned by producers (market value plus direct subsidies).

Our estimates of commodity specific subsidy rates for the two countries are shown in Table 7.[18] As in the case of tariffs and NTBs, the structure of subsidization is very similar in the two countries.

Grains, live animals, other agricultural products, meat products, dairy products and sugar are highly subsidized in both countries. In Canada, the subsidy rate is highest for dairy products (58 per cent), followed by sugar (40 per cent) and grains (24.5 per cent). In the United States, sugar ranks first (60 per cent), followed by dairy products (46 per cent). The subsidy rate on wheat is 33.0 per cent in Canada and 45.0 per cent in the United States. Both Canada and the United States also heavily subsidize barley production (about 30 per cent). Corn and rice are also heavily subsidized in the United States (see Table 8). It should be noted that bilateral trade in most of these commodities is not large.

Subsidy rates for non-agricultural commodities are relatively small in both Canada and the United States. The Canadian subsidy rates are in general higher than American rates, although for most commodities, subsidy rates vary within a small range (0 to 2.5 per cent). In Canada, mining and fishing industries are fairly

Table 7

Canadian and U.S. Estimated Subsidy Rates by Commodity Groups,*

Commodity (I/O-M aggregation)	Canada Subsidy Rate	U.S.A. Subsidy Rate
	(Per cent)	
Grains	24.5	31.8
Live Animals	13.5	12.0
Other Agricultural Products	14.0	13.0
Forestry Products	1.6	0.0
Fish Landings	20.7	0.0
Hunting and Trapping Products	0.0	0.0
Iron Ores and Concentrates	0.3	0.0
Other Metal Ores and Concentrates	0.4	0.0
Coal	6.0	0.0
Crude Mineral Oils	6.0	0.0
Natural Gas	6.0	0.0
Non-metallic Minerals	2.9	0.0
Services Incidental to Mining	0.0	0.0
Meat Products	12.0	14.0
Dairy Products	58.0	46.0
Fish Products	1.2	0.0
Fruits and Vegetables Preparations	1.2	0.0
Feeds	1.1	0.0
Flour, Wheat, Meal and Other Cereals	1.2	0.0
Breakfast Cereal and Bakery Products	1.2	0.1
Sugar	40.0	60.0
Miscellaneous Food Products	1.2	0.1
Soft Drinks	0.0	0.0
Alcoholic Beverages	0.2	0.0
Tobacco Processed Unmanufactured	0.0	0.0
Cigarettes and Tobacco Manufactured	0.0	0.0
Tires and Tubes	0.0	0.0
Other Rubber Products	0.5	0.0
Plastic Fabricated Products	0.5	0.0
Leather and Leather Products	0.8	0.1
Yarns and Man Made Fibres	0.6	0.0
Fabrics	0.6	0.0
Other Textile Products	0.6	0.0
Hosiery and Knitted Wear	0.6	0.1
Clothing and Accessories	0.4	0.0
Lumber and Timber	0.8	0.3
Veneer and Plywood	0.8	0.3
Other Wood Fabricated Materials	0.8	0.3
Furniture and Fixtures	0.5	0.1
Pulp	1.2	0.2
Newsprint and Other Paper Stock	1.2	0.2
Paper Products	1.1	0.2

Table 7 (Cont'd)

Commodity (I/O-M aggregation)	Canada Subsidy Rate	U.S.A. Subsidy Rate
	(Per cent)	
Printing and Publishing	1.0	0.0
Advertising, Print Media	1.0	0.0
Iron and Steel Products	0.4	0.8
Aluminum Products	0.4	0.0
Copper and Copper Alloy Products	0.4	0.0
Nickel Products	0.4	0.0
Other Non-ferrous Metal Products	0.4	0.0
Boilers, Tanks and Plates	0.4	0.4
Fabricated Structural Metal Products	0.5	0.4
Other Metal Fabricated Products	0.5	0.4
Agricultural Machinery	0.6	0.4
Other Industrial Machinery	0.7	0.4
Motor Vehicles	0.6	0.5
Motor Vehicle Parts	0.6	0.5
Other Transport Equipment	1.0	0.5
Appliances and Receivers, Household	0.8	0.3
Other Electrical Products	1.2	0.3
Cement and Concrete Products	0.3	0.0
Other Non-metallic Mineral Products	0.3	0.2
Gasoline and Fuel Oil	2.5	0.0
Other Petroleum and Coal Products	2.0	0.0
Industrial Chemicals	0.4	0.3
Fertilizers	0.3	0.3
Pharmaceuticals	0.4	0.3
Other Chemical Products	0.4	0.3
Scientific Equipment	0.6	0.3
Other Manufactured Products	0.8	0.1

* Canadian and American subsidy rates for agriculture relate to the 1984-86 period. For nonagricultural commodity groups, the subsidy rates relate to 1984 for Canada and 1976 for the United States.

Source Lodh and Magun (1987).

Table 8

Agricultural Subsidies: Producer Subsidy Equivalent, Canada and the United States, 1982-86

	Commodity	Canada	United States
	Grains	(Proportional subsidy in percentages)	
1.	Wheat*	33.0	45.0
2.	Corn	5.0	30.0
3.	Rice	-	33.0
4.	Oats	6.0	-
5.	Barley	28.5	30.0
	Other Agricultural Products		
6.	Canola (rapeseed)	14.0	-
7.	Soybeans	7.0	7.0
8.	Cotton	-	40.0
	Meat Products		
9.	Beef	7.0	7.0
10.	Pork	2.5	5.0
11.	Poultry meat	15.0	7.0
12.	Sheep meat	4.0	-

* Relates to 1986.

Source Government Intervention in Agriculture, U.S. Department of Agriculture, Economic Research Service, FAER-229, Washington, D.C., April 1987, and authors' estimates.

heavily subsidized (6 per cent for mining and 20.7 per cent for fishing). In contrast, mining and fishing in the U.S. do not receive any subsidies.

In summary, our calculations suggest that, on average, Canadian producers receive slightly more subsidies (PSEs) then their American counterparts. However, the structure of subsidies is very similar in the two countries. Both countries heavily subsidize their farm products.

In view of the serious conceptual difficulties involved in quantifying the economic impact of subsidies and the broad similarity of both the level and structure of subsidy rates in the two countries, we have not incorporated subsidies into our free trade simulations. Moreover, it is generally agreed that a bilateral agreement on subsidies, especially agricultural subsidies, will not be easy. Multilateral trade negotiations in the Uruguay Round may provide the best opportunity to seek better solutions to the trade problems associated with subsidies.

Gains in Manufacturing Productivity: Industry Scale Economies and Rationalization

Pioneering research done for the Council in the late 1960s and the early 1970s concerning U.S.-Canada labour productivity and per capita income comparisons and scale economies concluded that Canada's productivity and real income were substantially below

U.S. levels, largely due to the poor productivity performance of the manufacturing sector.[19] This, in turn, was attributed to inefficient production practices, such as the use of small and inefficient plants and short production runs. This gap was seen to be a direct result of the small Canadian market. Therefore it was argued that, by opening up a much larger market and permitting Canadian producers to take advantage of scale economies and specialization, free trade with the U.S. would improve productivity and raise real incomes in Canada. Hence, the size of the potential gains in productivity and real income from a free trade agreement was viewed as depending critically on the magnitude of the prevailing U.S.-Canada productivity gap and the importance of scale economies in explaining this gap.[20]

In view of the current Canada-U.S. free trade debate and the conflicting evidence about the size of the Canada-U.S. productivity gap and the importance of scale economies, we have reviewed all the available empirical evidence in order to provide some perspective on this very important subject.[21]

Comparisons of per capita income and productivity on a country by country basis often use market exchange rates for currency conversions. Such measures provide data in a common currency but are valued at different sets of prices. Consequently, international comparisons of productivity or living standards based on market exchange rates reflect not only differences in the

quantities of goods and services produced or consumed in different countries, but also differences in price levels between countries. Furthermore, the relationship between the nominal and the real figures tends to be quite unstable over time because exchange rates are liable to fluctuate significantly over fairly short periods. The recent experience of the U.S. dollar is a case in point. Therefore, using market exchange rates to convert national currencies into a common currency is apt to produce extremely unreliable and seriously misleading indicators of relative productivity and standards of living across countries.

To help overcome this problem, economists have devised purchasing power parity (PPP) exchange rates for purposes of real quantity comparisons across countries. A PPP is an "international" price index calculated by comparing the prices of the same commodities in different countries. It is an index of the relative national price level and has the same dimensions as an exchange rate. Thus, currency conversions with the PPP provide data in a common currency valued at common set of prices which can be used in international comparisons of productivity and per capita income.[22]

Using the aggregate benchmark bilateral PPP rate for 1985 developed at the OECD, we have updated and extended their Canada/U.S. aggregate labour productivity (GDP per person employed) series, to cover the years from 1961 to 1986. Similarly, the tradable goods PPP (a measure of total goods less

construction) from the latest OECD study is used to compute the manufacturing PPP rate for the years 1961-1986, in order to convert the Canadian manufacturing productivity estimates into U.S. dollars.

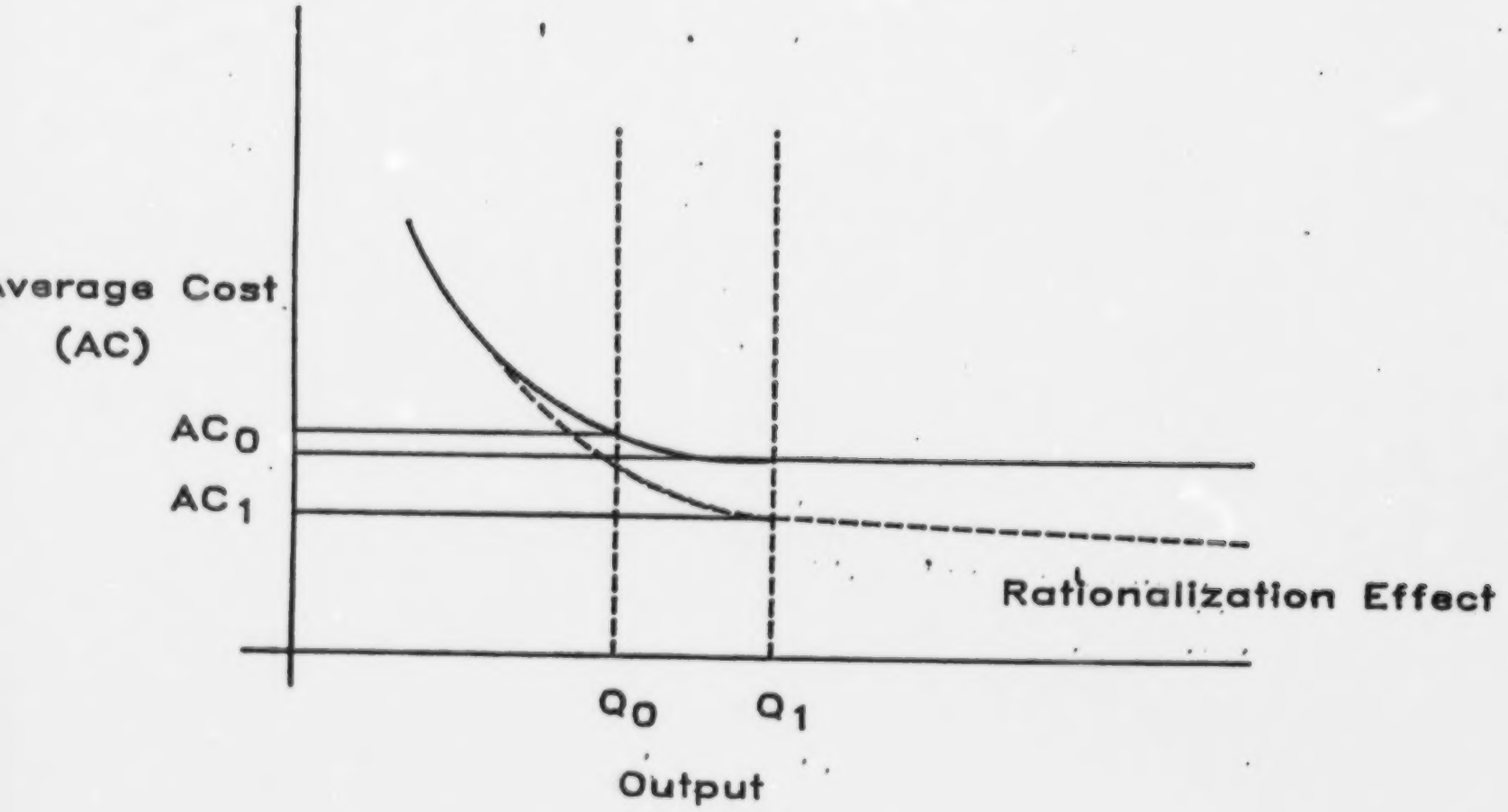
It is commonly argued that a small country such as Canada would benefit much more from liberalized trade through two main types of scale economies: industry size economies and rationalization (or restructuring) of the industry. Economies of industry scale measure the response of average costs to changes in the level of industry output. The important sources of industry scale economies include: indivisibilities, economies of specialization and mass resources, superior organization of production process, and the like.[23]

In addition to economies of industry size, free trade could significantly improve productivity by inducing changes in the structure of manufacturing industries. The Canadian manufacturing industry includes a large number (close to 70 per cent) of small and suboptimal plants, operating with above average unit costs. Removal of tariff and non-tariff barriers through increased import competition would force Canadian manufacturing firms to rationalize their operations and reduce their average costs. Increased domestic competition would reduce the number of suboptimal plants through mergers and takeovers. In other words, free-trade-induced restructuring would increase the average plant size in manufacturing.

Gains in manufacturing productivity from bringing suboptimal plants to or above the minimum efficient scale (MES) levels by consolidating the industry could be more important than gains due to increases in the size of the industry. The size of potential gains in total factor productivity (reduction in average cost) due to rationalization in any given industry depends upon the number of suboptimal plants, their share in the industry's total output, and the sensitivity of plant-specific average costs to changes in plant size. The average cost of production at the MES should be considerably less than at lower levels of production. The MES refers to the scale of minimum production cost. The size of rationalization gains is independent of changes in the size (output) of the industry. In other words, productivity gains from restructuring of the industry are derived from a downward shift of the industry's average cost curve (that is a given amount of output is produced with lower unit costs). In contrast, the industry size economies refer to movements along the industry average cost curve (from Q0 to Q1 in Chart 2), whereby a reduction in average costs is derived from increases in the size (output) of the industry.

Nevertheless, one could argue that the gains in efficiency (total factor productivity) from rationalization could also be realized through an effective competition policy. This is true, but freer trade is a very effective, efficient, and neutral instrument for fostering competition and hence rationalization.

Average Cost Saving (industry) Due to Scale Economies and Rationalization



Canadian aggregate labour productivity improved substantially vis-à-vis the U.S. over the period 1961-80. For example, our aggregate labour productivity has increased from 75.5 per cent of the U.S. level in 1965 to about 89 per cent in 1980. However, since 1980, the aggregate productivity gap has remained more or less stable. In 1986, Canadian productivity (GDP per person employed) was 9 per cent below the U.S. level (see Table 9).

Unlike aggregate labour productivity, Canadian manufacturing labour productivity (GDP per person-hour), compared to that of the U.S., remained constant over the period 1970-80, at about 18 per cent below the U.S. level. Furthermore, the manufacturing labour productivity gap substantially widened over the period 1980-86, increasing from 18 per cent in 1980 to 26 per cent in 1986 because of faster growth in American labour productivity (see Table 9). Differences in output growth account for the widening of the gap between the U.S. and Canadian productivity growth rates over this period.

Estimates of the aggregate and manufacturing labour productivity gap imply that the manufacturing sector continues to be a big drag on Canadian aggregate labour productivity. Furthermore, its contribution to the overall productivity gap has risen steadily, from about 20 per cent in 1965 to over 55 per cent in 1986, largely due to better labour productivity performance in the Canadian non-manufacturing sector (including primary industries, construction, and services).

Table 9

Comparisons of Canada/U.S. Labour Productivity

(U.S. = 100)

Year	Aggregate labour productivity[1]	Manufacturing labour productivity[2]
1965	75.5	73.0
1970	79.5	83.0
1975	86.0	83.0
1980	89.3	82.0
1986	91.0	74.0

1 GDP per person employed.
2 GDP per person-hour worked.

Source: U.S. - Canada Productivity Gap, Scale Economies and the Gains from Freer Trade: A Review Article, by P. S. Rao, Economic Council of Canada (mimeo).

In view of the significant trade liberalization achieved under the Kennedy and Tokyo rounds of multilateral trade negotiations and a substantial increase in Canadian exports and imports, the lack of improvement in the manufacturing labour productivity gap over the period 1965-86, especially the recent deterioration, (1980-86), is puzzling. This poor labour productivity performance could be due to such factors as the decline in terms of trade, poor management practices, slower adoption of best practice technology, incomplete factor mobility, wage-price rigidities, relatively large adverse impact of the two energy price shocks on output and inflation, and the severity of 1981-82 recession.[24] In addition, during the 1980-86 period the U.S. manufacturing industries considerably rationalized their operations and became more cost-efficient, in response to the substantial loss in competitiveness due to the large appreciation of the U.S. dollar (close to 50 per cent).

In summary, a large part of the 9 per cent aggregate labour productivity and per capita income gap between the U.S. and Canada is caused by Canada's relatively low manufacturing labour productivity. Canada-U.S. free trade, by increasing competition in the Canadian economy and providing freer access to a much larger market, could considerably reduce the manufacturing labour productivity gap and improve real incomes in Canada.

Econometric Estimates

Our review of the empirical estimates of industry scale parameters for 20 two-digit manufacturing industries indicates only slight increasing returns to scale in the Canadian manufacturing sector resulted from a free-trade agreement with the United States.[25] At the aggregate level, these results suggest a range of 0.95 to 1.06 for the scale parameter, with a median of about 1.03, indicating slightly increasing productivity returns to gains in the size of the industry. This finding of only modest aggregate productivity gains from increases in industry size is also true for the individual manufacturing industries. The scale parameter estimates vary within a narrow range of 1.0 to 1.10 (see Table 10).

As mentioned before, close to 70 per cent of all plants in the Canadian manufacturing industries are below the MES levels. These plants account for only 20 per cent of total industry output and operate with very high average costs. Therefore, the gains in economic efficiency from rationalization (restructuring of industry through consolidation of the small plants) could be significant, even if the gains from <u>industry size</u> economies turned out to be small. The available estimates suggest that if all the suboptimal plants were to operate at the M.E.S. level, total unit costs could, on average, decline 3.8 per cent in the manufacturing sector. The overall Canada-U.S. productivity gap would therefore decline. Since the manufacturing sector's gross output accounts

Table 10

Average Cost Saving from Rationalization in Canadian Manufacturing Industries
(Based on 1979 data)

	Scale[1] parameter	Total number of plants	Suboptimal production (1979) [per cent of total production][2]	Proportion of suboptimal plants (per cent)	Average cost disadvantage due to suboptimal production (per cent)[3]	Productivity estimate (per cent)[4]
Food and beverages	1.19	4,795	26.76	69.2	4.16	8.9
Tobacco products	1.00	26	--	--	0.00	0.0
Rubber and plastics	1.01	999	8.41	61.4	1.15	1.5
Leather	1.04	447	27.40	68.0	3.28	4.6
Textiles	1.03	967	15.08	42.0	3.59	5.0
Knitting mills	1.04	281	22.13	55.7	2.24	2.9
Clothing	1.02	2,179	38.16	69.0	2.75	3.6
Wood Products	1.02	3,208	21.33	76.2	3.49	4.9
Furniture and fixtures	1.03	2,190	22.78	74.4	3.73	4.4
Paper and allied industries	1.10	732	56.89	42.6	6.73	9.7
Printing and publishing	1.01	4,093	37.98	93.7	5.08	4.8
Primary metals	1.00	441	12.27	25.5	1.03	1.5
Metal fabricating	1.04	4,862	19.46	69.8	3.79	4.7
Machinery	1.00	1,491	19.16	81.0	2.50	3.8
Transportation equipment	1.00	1,216	1.43	13.4	5.10	11.0
Electrical products	1.06	1,076	33.89	76.0	6.94	9.1
Nonmetallic mineral products	1.08	1,566	29.86	71.4	5.53	6.2
Petroleum and coal products	1.02	108	--	--	1.00	5.9
Chemical and chemical products	1.02	1,212	17.15	62.9	2.15	3.2
Miscellaneous manufacturing	1.05	2,693	15.21	75.1	6.61	8.5
Weighted 2-digit industry average	1.06	34,578	19.65	69.3	3.81	6.1

1 Greater than 1 implies increasing returns to scale; less than 1 implies decreasing returns; and equal to 1 means constant returns to scale.
2 Per cent of total industry output produced by the suboptimal plants.
3 Based on total costs, including intermediate inputs.
4 Based on value added data (net output), total factor productivity. Only half of the potential cost savings (gross output basis) due to rationalization (Col. 3) are assumed to get realised from the Canada-U.S. free trade. These in turn are covered into value added basis by multiplying them by the ratio of gross output to value added (industry specific). For a detailed discussion of the weighting proceddures, see Hulten (1978) and Jorgensen (1980).

Source: U.S. - Canada Productivity Gap, Scale Economies and the Gains from Freer Trade: A Review Article, by P. S. Rao, Economic Council of Canada (Mimeo).

for over 60 per cent of GNP, the gains in GNP and real income from this source alone, even without accounting for any favourable indirect effects, could be over 2.0 per cent (see Table 10).[26]

Estimates were developed of the potential productivity gains from plant rationalization in each industry associated with a Canada-U.S. free trade agreement that eliminated all tariff and most non-tariff barriers. They are derived on the assumption that only half of the potential cost savings due to rationalization would be realized from Canada-U.S. free trade. The productivity gains range from a high of 11 per cent for transportation equipment to a low of 0 per cent for the tobacco products industry (see Table 10). For manufacturing as a whole, the estimate of potential productivity gains for the manufacturing industry, weighted according to industry output, comes to 6.1 per cent (based on the value-added concept). Naturally, this would not occur overnight, but rather over a period of time in which substantial adjustment and plant modernization would occur. One important qualification must, however, be made immediately. All plants seldom operate at the MES level. Even when some plants are operating at sub-optimal (higher cost) size levels, this does not necessarily mean that they are inefficient. They may be producing more customized or specialized products than the lowest cost firms in the industry -- products that meet a more limited demand. In such cases of 'product niche-finding' one would not always expect plants to expand under free trade.

It must be acknowledged that the considerable inter-industry variation in the potential productivity gains and the marked variations in the numbers of optimal and sub-optimal plants within each industry, imply considerable adjustment problems for weak industries and those with large numbers of inefficient plants. This is particularly true for such nondurable manufacturing industries as paper and allied products, printing and publishing, miscellaneous manufacturing, and food and beverages. These industries contain a large proportion of small and inefficient plants, and the estimated percentage of cost savings due to their rationalization is well above the average for manufacturing as a whole. For example, in the printing and publishing industry, almost 94 per cent of all existing plants, accounting for 38 per cent of the industry output, are below the minimum average cost scale, suggesting substantial restructuring is possible.

The rationalization of an industry takes time, and it often causes pain to those communities or workers facing a plant shutdown. Fortunately, the majority of plants do not shut down. Rather, through new management or new investment (or both) they revitalize, strengthen, and expand their output and sales. Moreover, the Canadian manufacturing sector, whatever its relative productivity vis-à-vis U.S. manufacturing, is very dynamic. Each year, on average, between 2,000 and 3,000 new plants are opened up, while almost as many are merged or closed down. Generally speaking, plant births exceed plant deaths. It is in this context that one must view the opportunities that North American free

trade offers many Canadian manufacturing enterprises. Indeed, in this and many other of the nondurable manufacturing industries, a large number of plants were identified in our earlier publication Innovation and Jobs in Canada as being in the low- and medium-technology intensity category, using less than state-of-the-art machinery, equipment, and materials, and in need of modernization.

Trade liberalization, by promoting domestic competition, could help to narrow the remaining productivity and real income gap in a number of other important ways, as for example by speeding up the reallocation of resources from declining to growing industries, by encouraging plants to adopt new technology more quickly, and by increasing the flexibility of markets. Indeed, such dynamic gains in efficiency from freer trade (though difficult to quantify) could be more important than those arising from scale economies and rationalization. These positive developments in turn could improve the trade-off between inflation and employment and increase the likelihood of stimuli to aggregate demand through fiscal and/or monetary policy, leading to higher output, and productivity and employment growth rather than increased inflation.

SECTION IV

DESIGN OF THE FREE TRADE SCENARIOS

Using available data on tariff and nontariff barriers (including contingency protection) in the two countries, the implications of non-discriminatory federal government procurement policies in both countries for Canadian exports and imports, and the potential gains in manufacturing productivity due to scale economies and rationalization presented in the previous section, we have designed the following two bilateral free trade scenarios:

Simulation 1 - the first scenario examines the impact of removing trade barriers on trade in goods between Canada and the United States on the Canadian economy;

Simulation 2 - in the second scenario, removal of trade barriers is supplemented by industry specific productivity increases in Canadian manufacturing industries.

Both scenarios are carried out with CANDIDE Model 3.0, under the flexible exchange rate regime. The base case projection used for this study was reported in the Council's 1986 Annual Review. The base case projection assumes no changes in trade policy beyond those currently scheduled. In the base case projection, the unemployment rate gradually declines from 9.4 per cent in 1987 to

6.6 per cent in 1995. Inflation (CPI) averages about 3.5 per cent over the projection period (1987-1995).

In these scenarios, the money supply is assumed to respond to changes in nominal GNP and interest rates. The Bank of Canada is assumed to allow nominal interest rates to vary with inflation expectations. In other words, real interest rates are assumed to remain constant at the base case levels. In CANDIDE Model 3.0, the exchange rate (US$/CAN$) appreciates in response to reductions in inflation expectations and increases in the basic balance (the sum of current and capital account balances) and vice-versa. Real short-term interest rate differentials also play an important role in determining the exchange rate.

Simulation 1 -Removal of Trade Barriers in the Two Countries

The removal of Canadian Post-Tokyo Round tariff rates and the nontariff barriers (tariff equivalents) displayed in Table 2 is achieved by adjusting the corresponding export and import prices in the model, weighted by the U.S. shares in total exports and imports (commodity specific). In the CANDIDE model, final demand prices, including the Consumer Price Index, are derived as weighted sums of import prices and value-added prices (domestic), where the weights are determined by the import content of that particular commodity. But in the CANDIDE model the weights also vary in response to changes in import prices relative to domestic prices. Therefore, the reduction of tariff barriers is fully

passed on to consumers and producers (imported materials) in the form of lower import prices.

However, in the CANDIDE model there is no direct relationship between import prices and domestic sector prices (GDP deflators). These prices are mainly influenced by sector-specific wage rates, productivity, the capacity utilization rate proxy, and the labour market tightness variable (the primary male unemployment rate). Consequently, in the two free trade simulations, sector prices decline over time in response to reductions in inflation expectations, exchange rate appreciation, and productivity improvements. Hence, in the model, any change in the differential between the import prices and domestic sector (output) prices increases the share of imported goods. In contrast, under the law-of-one-price (price taker assumption), domestic (output) prices respond fully (100 per cent) to changes in import prices.[27]

The removal of U.S. Post-Tokyo Round tariff rates and the nontariff barriers, recorded in Table 2, is introduced into the model by adjusting export volumes. Percentage changes in export volumes are computed by multiplying the percent changes in export prices (implied by the changes in tariffs and nontariff barriers) and the export price elasticities. These changes in turn are multiplied by the base case export volumes to compute level changes in export volumes (constant adjustments). In most of the cases, CANDIDE export price elasticities are used. In a

few cases where CANDIDE elasticities take on extreme values (either too large or too small), we have constrained them to unity.

Liberalization of federal government procurement practices in the two countries is introduced by adjusting the volume of imports and exports (commodity specific) according to the estimates shown in Table 6. The federal government revenue shortfall due to the removal of Canadian custom duties is offset by increased personal income taxes, so that the federal government deficit remains more or less same as the base case levels in the two free trade scenarios.

Since the base case is extended only up to 1995, all the trade barriers in the two countries are assumed to be removed at once in 1987 to capture the longer-range effects of Canada-U.S. free trade. We realize that the upcoming free trade agreement would probably allow a fairly extensive phase-in period. However, last year's simulation results, reported in the 1986 Annual Review, suggest that the longer range effects are largely independent of the phase in period. But the short-term effects of free trade (including both costs and benefits) would be significantly smaller than the current simulation results if the trade barriers were removed gradually over a number of years.

Simulation 2 - Canada-U.S. Free Trade Supplemented by Productivity Improvements in the Canadian Manufacturing Sector

Estimates of potential cost savings (total factor productivity improvements) due to rationalization in the twenty manufacturing industries, based on total costs data (gross output), are displayed in Table 10, column 5. However, actual cost savings (productivity improvements) in manufacturing due to restructuring could be less than the potential gains, for the following reasons:

First, these estimates are based on 1979 census data. Since then, high real interest rates, a severe recession in 1981-82 and the weak recovery thereafter, and the increased competition from imports have forced a great number of companies to rationalize their operations, implying that some of the estimated gains in productivity due to scale economies and rationalization might have already been realized or would be realized over the base case period (1987-1995) irrespective of Canada-U.S. free trade. Second, the observed constancy of the U.S.-Canada manufacturing productivity gap between 1970 and 1980 and the marked deterioration in Canadian manufacturing productivity relative to American manufacturing productivity, suggest that the actual gains in productivity could fall short of potential gains. Finally, due to the rapid pace of technical change in communications and electronic media and a rapid growth in product innovations, plant size is becoming less important in productivity enhancement. In

view of these considerations, for each of the manufacturing industries only half of the potential gains in total factor productivity (cost savings) due to rationalization, reported in column 5 or Table 10, are introduced in simulating the impact of Canada-U.S. free trade on output and employment in Canada (see column 6 of Table 10).

Improvements in total factor productivity (the production of more output for any given amount of input) in the manufacturing industries due to scale economies and rationalization are introduced by adjusting output and employment.[28] Gains in manufacturing productivity due to scale economies are computed in accordance with changes in manufacturing sector outputs under trade liberalization (Simulation 1) and sector-specific scale factors (see Table 10, column 1). These gains in productivity from scale economies are introduced by adjusting output and employment, as in the case of rationalization gains.

SECTION V

SIMULATION RESULTS

Using the new data on trade barriers in the two countries and sector specific productivity improvements, we have simulated the impact of Canada-U.S. free trade on the Canadian economy both by industrial sector and by province. These results strongly suggest that bilateral free trade with the U.S. will provide substantial net benefits to Canadians in the form of additional employment and real income, and that these benefits will be distributed fairly uniformly across all regions. Free trade will also facilitate the necessary structural adjustments in the Canadian economy and prepare Canadians to compete much more vigorously in the world economy in the 1990s and beyond. Moreover, our simulation results also suggest that the adjustment costs in terms of job losses in the declining industries will be fairly modest.

Aggregate Results

The macro-economic effects of Canada-U.S. free trade are summarized in Tables 11 to 14. These results imply that bilateral free trade with the United States will improve real wages, increase output and employment, stimulate business investment and productivity, lower prices, reduce government budget deficits, and strengthen the Canadian dollar vis-à-vis the U.S. dollar in both scenarios.

Table 11

Macroeconomic Effects of Canada-U.S. Free Trade: Major Indicators

Indicator	1987	1990	1993	1995
		(Per cent difference)		
GNE (1981 $)				
SIM 1	1.0	1.6	1.8	1.6
SIM 2	1.1	2.8	3.4	3.3
CPI (Index)				
SIM 1	-1.3	-2.7	-3.6	-3.6
SIM 2	-1.7	-4.5	-5.9	-5.7
Productivity (GNE per person employed)				
SIM 1	0.8	0.5	0.5	0.2
SIM 2	1.1	1.3	1.1	0.7
Real wage rate (per person hour)				
SIM 1	1.4	1.5	1.8	1.9
SIM 2	1.8	2.4	2.6	3.0
Real disposable income				
SIM 1	0.7	1.1	1.6	1.7
SIM 2	1.0	2.1	2.8	3.1
Investment expenditure (1981 $)				
SIM 1	0.2	4.6	4.0	4.0
SIM 2	0.3	5.9	6.4	7.0
		(Level difference)		
Employment (thousands)				
SIM 1	38	144	167	189
SIM 2	12	187	295	350
Labour force (thousands)				
SIM 1	0	37	64	82
SIM 2	-4	26	110	154
Unemployment rate (per cent)				
SIM 1	-0.3	-0.8	-0.8	-0.6
SIM 2	-0.1	-1.0	-1.4	-1.3
Total government deficit ($ billions)				
SIM 1	1.6	3.6	3.5	3.2
SIM 2	1.5	4.5	5.6	5.2

Source: CANDIDE Model 3.0, June 1987.

Table 12

Percent Change in Final Demand (Real Terms) in 1995

	Simulation 1	Simulation 2
Consumer expenditures	2.2	4.1
Government expenditure on goods and services	-0.1	-0.1
Capital formation	4.0	7.0
Exports of goods and services	1.5	2.7
Imports of goods and services	3.6	4.9
GNE	1.6	3.3

Source: CANDIDE Model 3.0, June 1987.

Table 13

Contribution of Components to Total Expenditure Change in 1990 and 1995

(Per cent of total change)

	Simulation 1		Simulation 2	
	1990	1995	1990	1995
Personal consumption	72.2	94.3	69.8	78.1
Business investment	61.4	54.1	42.6	43.3
Government expenditure	-0.4	0.0	-0.4	0.0
Change in inventories	0.0	1.6	0.7	1.1
Net exports	-33.2	-48.6	-12.7	-22.5
Total change	100.0	100.0	100.0	100.0

Source: CANDIDE Model 3.0, June 1987.

Table 14

Response of Wages and Prices to Canada-U.S. Free Trade

	1987	1990	1993	1995
Import price (index)				
SIM.1	-4.4	-5.7	-6.9	-7.0
SIM.2	-4.2	-5.4	-7.2	-7.5
CPI (Index)				
SIM.1	-1.3	-2.7	-3.6	-3.6
SIM.2	-1.7	-4.5	-5.9	-5.7
GDP deflator (index)				
SIM.1	-0.2	-1.7	-2.6	-2.4
SIM.2	-0.7	-4.0	-5.6	-5.1
Hourly wage rate				
SIM.1	0.1	-1.2	-1.8	-1.7
SIM.2	0.1	-2.1	-3.3	-2.7
Real wage rate (per person hour)				
SIM.1	1.4	1.5	1.8	1.9
SIM.2	1.8	2.4	2.6	3.0
Exchange rate ($ U.S./$ Can.)				
SIM.1	1.1	2.6	4.0	4.2
SIM.2	1.1	2.3	4.4	4.8

Source: CANDIDE Model 3.0, June 1987.

Removal of trade barriers (including both tariff and non-tariff barriers) in the two countries will, on average, reduce import prices in Canada by 4.2 per cent in the first year of the shock (1987). This in turn will translate into lower consumer prices (1.7 per cent) and higher real wages (1.8 per cent). However, initially part of the increase in real income will be offset by increased personal income taxes, to cover the loss in tariff revenue.

The removal of tariff barriers will increase both exports and imports. Since on average Canadian trade barriers are larger than American, imports would rise more than exports, dampening some of the real income stimulus to the Canadian economy. For example, in Simulation 2, the change in net exports reduces real output (GNE) by 0.1 per cent in 1990. Furthermore, over time increases in real activity and the associated strength in consumer expenditure and business investment will accelerate the growth in imports and increase the drag on the Canadian economy. (See Tables 11 and 13).

However, the rise in consumer expenditure and business investment resulting from improvements in real income will eventually more than offset the reductions in net exports, thereby increasing both output and employment. In 1987, the first year of bilateral free trade, GNE will be 1.1 per cent above the base case solution (Sim.2).

Initially, most of the stimulus to output translates into increased productivity, putting further downward pressure on prices. Reductions in final demand prices (consumption and investment) and productivity improvements set in motion a "virtuous cycle" of wage-price reduction and exchange rate appreciation (see Table 14). Consequently, the reduction in the consumer price index increases from 1.7 per cent in 1987 to 5.7 per cent in 1995 in Simulation 2. Similarly, in 1995 the value of the Canadian dollar would be 4.8 per cent above its projected value relative to the U.S. dollar (SIM.2). Since lower inflation requires fewer savings to maintain the real value of financial assets, the personal savings rate will decline in response to reductions in inflation expectations, giving a further boost to consumer expenditure. For instance, in Simulation 2, the personal savings rate is 1.0 percentage points below the base case level in 1995.

Increased economic activity, lower costs for imported machinery and equipment, increased capacity utilization rates, and improved cash flow will further stimulate business investment, contributing substantially to the overall increase in output and employment. In 1995, business investment would be 7.0 per cent above the base case level ((SIM.2), see Table 11).

Higher output and real wage increases will expand both labour supply and employment. However, the increase in the latter will be significantly larger than the increase in the former, thus

reducing the unemployment rate. For example, the unemployment rate would be 1.3 percentage points below the base case level in 1995 (Simulation 2).

Increased economic activity, a reduction in the unemployment rate, and lower inflation will raise revenue and cut expenditures (transfer payments) for all levels of government, thereby reducing deficits. For example, in 1995, total government deficits will be $5.2 billion below the base case level in Simulation 2 (see Table 11).

In summary, these simulations show that bilateral free trade with the U.S. would considerably increase overall output and employment in Canada. By 1995, Canada-U.S. free trade would increase GNE by an estimated 3.3 per cent and create 350,000 new (net) jobs in Canada. Even without productivity improvements in manufacturing industry due to scale economies and rationalization, the impetus to output and employment from free trade will be substantial. For instance, the net addition to employment in 1995 would be about 189,000, instead of 350,000 under the second scenario (see Table 11). However, bilateral free trade will reduce net exports, worsen the current account balance and increase the reliance on foreign savings (increased capital inflows).

Output and Employment Effects by Industry

Canadians are not concerned only with the aggregate effects of bilateral free trade with the United States; they are also concerned about its potential effects on individual industries and regions. By linking the aggregate results from CANDIDE 3.0 to the Statistics Canada Input-Output Model, we have estimated the longer range effects (to 1995) of Canada-U.S. free trade on output and employment by industry. The industrial distribution of the aggregate changes in output and employment from bilateral free trade is shown in Tables 15 to 17.

In most of the industries (29 out of 36 analyzed here), the net impact of bilateral free trade on output and employment will be positive and significant (see Table 15), with primary industries, construction, and service sectors accounting for close to 85 per cent of the gains in output and employment in Simulation 2. Employment in the service sectors would expand at a healthy pace in response to increased domestic demand. For example, four service industries - retail and wholesale trade, and commercial, personal and business services - alone would contribute close to 65 per cent of all the new jobs (see Table 17). These substantial gains in service sector output and employment reflect the importance of services in the modern Canadian economy and the size of indirect effects of free trade on the Canadian economy.

Table 15

Impact of Canada/U.S. Free trade on Output (GDP) and Employment by Sector in 1995

(Per Cent Change)

		Simulation 2	
		Output	Employment
1	Agriculture	1.98	1.90
2	Forestry	3.93	2.16
3	Fishing, hunting, and trapping	1.97	1.76
4	Mining	3.20	4.70
5	Food and beverage	3.81	2.85
6	Tobacco products	0.26	0.27
7	Rubber and plastic products	-0.74	-0.67
8	Leather products	-7.15	-5.15
9	Textile	-0.98	-0.70
10	Knitting mills	-1.54	-1.35
11	Clothing	2.75	2.57
12	Wood	5.34	5.03
13	Furniture and fixtures	2.52	2.38
14	Paper and allied	1.24	1.11
15	Printing and publishing	7.57	7.05
16	Primary metal	5.77	3.90
17	Metal fabricating	3.05	2.82
18	Machinery	3.33	2.75
19	Transportation equipment	1.98	1.55
20	Electrical products	-2.80	-2.47
21	Nonmetallic mineral	3.92	2.76
22	Petroleum and coal	1.83	1.32
23	Chemical and chemical products	0.57	0.59
24	Miscellaneous manufacturing	-0.99	-1.15
25	Construction	7.47	6.67
26	Transportation and storage	2.66	2.60
27	Communication	0.51	0.77
28	Electrical power, gas, other	2.68	1.93
29	Wholesale trade	3.66	3.42
30	Retail trade	4.36	4.08
31	Other finance and real estate	4.25	3.90
32	Education and health services	3.49	4.94
33	Amusement and recreation	5.49	2.25
34	Services to business management	3.48	1.62
35	Accommodation and food	4.43	2.74
36	Other personal and miscellaneous	0.90	0.88
	Total	3.3	2.6

Source: Estimates by the Economic Council of Canada, June 1987.

Table 16

Impact of Canada/U.S. Free Trade on Output (GPD) and Employment by Sector in 1995

(Per cent Change)

		Simulation 1	
		Output	Employment
1	Agriculture	0.59	0.60
2	Forestry	3.35	1.97
3	Fishing, hunting, and trapping	1.42	1.35
4	Mining	0.77	0.86
5	Food and beverage	2.02	1.66
6	Tobacco products	0.05	0.07
7	Rubber and plastic products	-2.53	-2.26
8	Leather products	-8.04	-6.20
9	Textile	-3.16	-2.52
10	Knitting mills	-3.80	-3.69
11	Clothing	1.10	1.10
12	Wood	4.44	4.53
13	Furniture and fixtures	0.47	0.44
14	Paper and allied	0.27	0.22
15	Printing and publishing	3.24	3.22
16	Primary metal	4.43	3.20
17	Metal fabricating	0.58	0.56
18	Machinery	1.11	0.99
19	Transportation equipment	0.99	0.89
20	Electrical products	-5.34	-5.03
21	Nonmetallic mineral	1.28	0.90
22	Petroleum and coal	0.67	0.51
23	Chemical and chemical products	-1.06	-0.82
24	Miscellaneous manufacturing	-3.63	-3.90
25	Construction	3.79	3.62
26	Transportation and storage	1.44	1.52
27	Communication	0.09	0.32
28	Electrical power, gas, other	1.40	1.08
29	Wholesale trade	2.08	2.08
30	Retail trade	2.60	2.60
31	Other finance and real estate	2.22	2.19
32	Education and health services	2.04	3.06
33	Amusement and recreation	3.24	1.41
34	Services to business management	1.77	0.88
35	Accommodation and food	2.48	1.64
36	Other personal and miscellaneous	0.51	0.54
	Total	1.6	1.4

Source: Estimates by the Economic Council of Canada, June 1987.

Table 17

Impact of Canada/U.S. Free Trade on Employment
(Absolute Change in the Number of People Employed)

		Simulation 1	Simulation 2
1	Agriculture	2,385	7,511
2	Forestry	2,555	2,797
3	Fishing, hunting, and trapping	414	539
4	Mining	3,599	6,708
5	Food and beverage	5,214	8,969
6	Tobacco products	6	23
7	Rubber and plastic products	-2,124	-629
8	Leather products	-1,637	-1,359
9	Textile	-1,537	-429
10	Knitting mills	-703	-258
11	Clothing	986	2,300
12	Wood	5,346	5,941
13	Furniture and fixtures	219	1,177
14	Paper and allied	353	1,746
15	Printing and publishing	4,405	9,642
16	Primary metal	5,361	6,542
17	Metal fabricating	769	3,850
18	Machinery	1,245	3,453
19	Transportation equipment	1,704	3,019
20	Electrical products	-6,672	-3,280
21	Nonmetallic mineral	603	1,850
22	Petroleum and coal	69	180
23	Chemical and chemical products	-876	625
24	Miscellaneous manufacturing	-2,471	-731
25	Construction	26,416	48,742
26	Transportation and storage	7,399	12,686
27	Communication	840	2,045
28	Electrical power, gas, other	1,552	2,774
29	Wholesale trade	13,836	22,744
30	Retail trade	49,161	77,111
31	Other finance and real estate	21,707	38,697
32	Education and health services	5,109	8,256
33	Amusement and recreation	3,735	5,947
34	Services to business management	14,845	27,304
35	Accommodation and food	18,077	30,169
36	Other personal and miscellaneous	8,110	13,339
	Total	189,000	350,000

Source: Estimates by the Economic Council of Canada, June 1987.

Within the manufacturing sector, durable industries would, on average, benefit more from bilateral free trade than the non-durable manufacturing industries. In fact, five of the six trade-negative industries (all in the manufacturing sector) would be the non-durable industries, (rubber and plastics, leather, textiles, knitting mills, miscellaneous manufacturing and electrical products). These industries are now highly protected in Canada, compared to the U.S., and therefore would undergo important structural adjustments. Similarly, furniture and fixtures, metal fabricating and machinery industries also get more trade protection in Canada than in the U.S. (see Table 15). But these industries' indirect benefits from Canada-U.S. free trade would more than offset the negative direct effects. Wood, primary metals, and printing and publishing would benefit proportionally more than the other trade-positive manufacturing industries.[29] The printing and publishing industry would receive substantial benefits from the positive indirect effects of free trade on real incomes and consumer expenditure. These effects would more than offset the small negative direct effect.

The loss in output and employment in the six trade negative industries would be fairly modest. For example, in Simulation 2, the total net employment reduction in these industries would be around 7,000 (see Table 17). This small job loss (in relation to the total employment in these sectors and the overall net increase in employment) in turn suggests that the adjustment costs from bilateral free trade would be fairly small, relative to the

overall gains in output and employment. However, to the extent that the employment losses were concentrated in depressed regions and single industry communities, free trade would exacerbate the adjustment problems. On the other hand, by providing considerable real income dividends to Canadians and increasing overall net employment, Canada-U.S. free trade could facilitate the introduction of new government policies and strengthening of ongoing social programs designed to cope with the problems of plant closures and job dislocation.

Relative changes in output and employment by industry under the first scenario (excluding productivity improvements) would be very similar to the distribution under the second scenario. However, manufacturing's share of the net additions to total output and employment would be significantly lower in the first scenario (see Table 17). For example, the manufacturing sector's share of the additional output would increase from about 5 per cent in the first scenario to 16 per cent in the second scenario. Moreover, in the trade-negative industries, the net employment loss would be somewhat larger than in the second scenario (about 16,000).

Provincial Impacts

For purposes of formulating appropriate regional economic development policies and assessing the distribution of adjustment costs across provinces, it is important to have an estimate of the regional impacts of Canada-U.S. free trade. Using the provincial

distribution of output and employment by industry- implicit in the Statistics Canada Regional Input-Output Model, the national industry effects are translated into regional industry impacts. Overall changes in output and employment by province are summarized in Tables 18 and 21 for the two free trade scenarios.

Provincial impacts are determined largely by changes in industries that are located in each province. Since 29 of 36 industries would gain from free trade, all provincial economies would experience increases in output and employment under a Canada-U.S. free trade agreement. Furthermore, as most of the gains would occur in service sectors and the provincial distribution of service sector output and employment is more or less similar to the distribution of overall output and employment by province, the gains from free trade would be relatively evenly distributed across all the provinces.

Under the second free trade scenario, regional changes in output (measured in per cent deviation from the base case levels) vary within a narrow range of 3.2 to 3.6 per cent. British Columbia (3.6 per cent), Alberta (3.5 per cent), Newfoundland (3.4 per cent), Nova Scotia (3.5 per cent), New Brunswick (3.5 per cent), anb Prince Edward Island (3.6 per cent) would gain slightly more then the average gains in output (3.3 per cent). This primarily reflects the relative importance of primary industries in these provinces and the relatively larger gains in output and employment in these industries to be achieved from the removal of U.S. trade

Table 18

Decomposition of Provincial Changes in GDP by Sector, SIM.2

Sectors	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
						(Per cent)					
Primary industries	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.6	0.7	0.3	0.3
Manufacturing - durables	0.1	0.0	0.2	0.2	0.3	0.5	0.3	0.1	0.1	0.5	0.3
Manufacturing - nondurables	0.4	0.4	0.3	0.4	0.3	0.3	0.3	0.1	0.1	0.2	0.3
Construction	1.1	1.0	0.9	0.9	0.7	0.6	0.6	0.8	0.9	0.8	0.7
Services	1.6	1.8	1.9	1.8	1.8	1.8	1.9	1.6	1.6	1.8	1.8
Total	3.5	3.6	3.5	3.5	3.2	3.2	3.3	3.3	3.5	3.6	3.3

N.B. Figures may not add due to rounding.

Source: Estimates by the Economic Council of Canada.

Table 19

Decomposition of Provincial Changes in Employment Sector, SIM.2

Sectors	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
						(Per cent)					
Primary industries	0.2	0.4	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.2	0.2
Manufacturing - durables	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.1	0.1	0.4	0.2
Manufacturing - nondurables	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2
Construction	0.7	0.8	0.5	0.5	0.4	0.3	0.4	0.5	0.8	0.4	0.4
Services	1.5	1.3	1.6	1.7	1.6	1.6	1.8	1.6	1.6	1.6	1.6
Total	2.8	2.7	2.7	2.7	2.5	2.5	2.7	2.6	2.9	2.7	2.6

N.B. Figures may not add due to rounding.

Source: Estimates by the Economic Council of Canada.

barriers, (especially the NTBs on softwood lumber, agriculture and fishing). Strong gains in the construction industry would add to the stimuli to these provincial economies (see Table 18). The Atlantic Provinces would also benefit from a healthy increase in economic activity in the food and beverage industry (especially fish processing).

In contrast, Quebec (3.2 per cent) and Ontario (3.2 per cent) would experience slightly less than average gains in output, because these two provinces have relatively more manufacturing than the others. More than three-quarters of the country's total manufacturing sector output is accounted for by these two provinces. Since all of the trade-negative industries are in the manufacturing sector, these two provinces will bear most of the adjustment costs (about 90 per cent), under Canada-U.S. free trade. However, they will also receive a lion's share (about 60 per cent) of the total benefits. The remaining provinces (Manitoba (3.3 per cent), and Saskatchewan (3.3 per cent) will record about average gains.

Provincial employment impacts reflect mainly the effects on output. Like changes in output, variations in employment changes across provinces will be very small (between 2.5 to 2.8 per cent for the second scenario). Likewise, the provincial distribution of gains in employment is very similar to the distribution of output effects (see Tables 18 and 19).

If trade liberalization is not accompanied by improvements in manufacturing productivity, the benefits from free trade will be substantially lower in all the provinces, because of the substantial positive effects of productivity improvements on prices, real incomes, consumer expenditures and investment. However, the provincial distribution of gains in output and employment will be similar to the results in the second scenario (see Tables 20 and 21).

Table 20

Decomposition of Provincial Changes in GDP by Sector, SIM.1

Sectors	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
						(Per cent)					
Primary industries	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.1
Manufacturing - durables	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1
Manufacturing - nondurables	0.1	0.2	0.1	0.1	0.0	-0.0	0.1	0.1	0.0	0.1	0.0
Construction	0.6	0.5	0.4	0.5	0.4	0.3	0.3	0.4	0.5	0.4	0.4
Services	0.9	1.0	1.1	1.0	1.0	1.0	1.1	0.9	0.9	1.0	1.0
Total	1.8	1.9	1.8	1.8	1.5	1.4	1.7	1.6	1.7	2.0	1.6

N.B. Figures may not add due to rounding.

Source: Estimates by the Economic Council of Canada.

Table 21

Decomposition of Provincial Changes in Employment Sector, SIM.1

Sectors	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
						(Per cent)					
Primary industries	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.2	0.1	0.1
Manufacturing - durables	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.3	0.1
Manufacturing - nondurables	0.2	0.2	0.0	0.1	-0.0	-0.0	0.1	0.1	0.0	0.1	0.0
Construction	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.5	0.2	0.2
Services	0.9	0.8	1.0	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0
Total	1.6	1.5	1.5	1.7	1.3	1.3	1.6	1.5	1.7	1.7	1.4

N.B. Figures may not add due to rounding.

Source: Estimates by the Economic Council of Canada.

SECTION VI

CONCLUSIONS

The objective of this paper has been to quantify the impact of Canada-U.S. free trade on the Canadian economy by industrial sector and by province. To achieve this goal, we have developed two free trade scenarios with CANDIDE Model 3.0. In the first scenario, existing tariff and nontariff trade barriers on goods (except subsidies) in the two countries are assumed to be removed in 1987. In the second scenario, the removal of trade barriers is assumed to be accompanied by improvements in manufacturing productivity resulting from industrial restructuring (rationalization) and freer access to a much larger market (scale economies).

These global results from the CANDIDE Model are linked with the Statistics Canada Input-Output Model to obtain the industry effects of output and employment. Using the industrial distribution of output and employment by province implicit in the Statistics Canada Regional Model, we have translated the national industry effects into regional effects by industry.

The most important findings of our study are:

(1) Canadian tariff rates (Post-Tokyo Round) are generally higher than their U.S. counterparts. The average Canadian tariff rate on goods is 3.8 per cent, compared to 2.3 per cent in the U.S. However, the structure of tariff protection is very similar in the two countries. Tariff protection is high for labour-intensive nondurable manufacturing industries in both countries.

(2) Contrary to the popular perception, the average size of nontariff barriers is significantly smaller than that of tariffs in the two countries. Unlike tariffs, nontariff barriers (tariff equivalents), on average, are generally larger in the U.S. (1.8 per cent) than in Canada (1.0 per cent). Nevertheless, the structure of nontariff protection is generally similar in the two countries.

(3) Like tariffs and nontariff barriers, the industrial distribution of subsidies is also very similar in the two countries. Both countries provide substantial subsidies to producers and distributors of grains, other agricultural products, meat, dairy products, and sugar. Because subsidies are roughly similar in the two countries and it is very difficult to estimate their economic impact, we have not included them in the two free trade scenarios.

(4) Canadian manufacturing has a large number (close to 70 per cent) of small plants, accounting for about 20 per cent of total

production. These small plants cannot take advantage of plant-specific scale economies. As a result, their average costs are significantly higher than industry average costs. Available estimates suggest that if all suboptimal plants were brought to or above minimum efficient scale levels, total industry average costs could decline by about 4 per cent, providing a substantial stimulus of about 2 per cent to aggregate productivity and real incomes. However, we have cut this in half in the simulations.

(5) Canada-U.S. free trade will increase output, real income and employment, lower prices, stimulate business investment, reduce the government deficits and strengthen the Canadian dollar vis-à-vis the U.S. currency.[30] However, it will worsen the current account balance (net exports) and increase Canada's dependence on foreign savings. The aggregate output and employment effects in the two scenarios are very similar to the results reported in the 1986 23rd Annual Review. Small differences between the two sets of results arise from data revisions with respect to tariffs, non-tariff barriers and the specific estimates of productivity gains within each industry.

In the first scenario, GNE will be 1.6 per cent above the base case level and net employment will increase by 189,000 by 1995. If the removal of trade barriers is accompanied by improvements in manufacturing productivity, closing some of the sizable manufacturing productivity gap between the two countries,

Canada-U.S. free trade will give a further substantial impetus to output and employment in Canada. Long-term (1995) gains in GNP go up from 1.6 per cent in the first scenario to 3.3 per cent in the second scenario. Similarly, net employment gains will increase from 189,000 in the first scenario to 350,000 in the second scenario, by 1995.

(6) Thirty of thirty-six industries will experience gains in output and employment in the second scenario (29 in the first scenario). Since the indirect effects of free trade, working through increased consumer expenditure and business investment, are overwhelming compared to the direct impacts on net exports, the service sectors and the construction industry will capture most of the gains in output and employment in the two scenarios. Primary industries will also record significant gains, mainly because of the removal of nontariff barriers on their exports to the U.S.

(7) Of the six trade-negative manufacturing industries, five are in the nondurable manufacturing sector. All these industries receive a relatively large amount of trade protection in Canada, and all are already facing stiff competition from the low-wage developing economies.

(8) The net loss in jobs (under 7,000) in the trade negative industries will be fairly small, compared to the overall gains (350,000) in employment, providing opportunities to adjust to

ongoing changes in comparative advantage in the world economy.

(9) The benefits of free trade will be distributed fairly evenly across all provinces. Since the service industries account for a very large proportion of the gains in output and employment and are fairly evenly distributed across all provinces, regional variation in gains from free trade will be quite small.

The Atlantic Provinces and British Columbia will experience slightly above average gains in output and employment (in percent terms), reflecting the relative importance of primary industries and construction in these provinces. On the other hand, Ontario and Quebec will gain slightly less than average (in percent terms), because of their large manufacturing base. Nonetheless, these two provinces will take about 60 per cent of the overall gains in output and employment in Canada.

In summary, these simulation results indicate that bilateral free trade with the U.S. would provide significant overall benefits to Canada, and that virtually all consuming and producing sectors in all of the provinces would share these gains.

However, as we have indicated before, the size of the impacts depends upon the nature of free trade implicit in the assumptions, and the structure and properties of the model used to simulate these impacts. Therefore, it is useful to assess qualitatively both the upside and the downside risks to the size of these

estimated impacts of Canada-U.S. free trade on the Canadian economy.

The following considerations suggest that the size of the estimated impacts of free trade on output, real income, and employment might be somewhat low.

First, in simulating the impact of Canada-U.S. free trade on the Canadian economy, we have not taken into account the positive effects of bilateral free trade on the U.S. economy and the resulting stimuli to Canadian exports, and thus to output and employment in Canada;

Second, in the CANDIDE Model 3.0, sector prices (GDP deflators) in the long term are determined as constant mark-ups over unit labour costs. Consequently, domestic sector prices do not respond to changes in import prices directly. However, because of market imperfections, the mark-up factors might vary directly with variations in import prices. If this were the case, the domestic prices would be directly affected by the elimination of tariff rates. The lack of this mechanism in the CANDIDE Model probably underestimates the favourable impact of free trade on prices, real incomes, output, and employment;

Third, in the the CANDIDE Model, business investment varies in response to changes in output, capacity utilization, cash flow position, and the cost of capital. Increases in output and

capacity utilization and reductions in the price of imported machinery and equipment would give a considerable stimulus to business investment in the two free trade scenarios. However, the model also does not capture other favourable impacts of free trade on investment, such as the accelerated modernization of plants and equipment and third country investment (increase in foreign direct investment from countries other than the U.S.). The omission of these factors (autonomous investment) may likewise under-estimate the favourable effects of free trade in Canada;

Fourth, we have assumed only free trade in goods. If Canada-U.S. free trade in goods also increased the free flow of services between the two countries, the benefits to both countries would be larger;

Fifth, Canada-U.S. free trade might also make Canadian service sectors more dynamic and narrow some of the U.S.-Canada productivity gap in these sectors (about 5 per cent in 1986), giving further stimuli to real income in Canada; and

Finally, free trade might also result in even faster adoption of new technology in Canada, improving productivity in the manufacturing as well as the nonmanufacturing sectors.

On the other hand, a number of other considerations suggest that the estimated impacts might be slightly on the optimistic side.

First, in our simulations, the terms-of-trade remain more or less constant for Canada. However, results from the general equilibrium models suggest that Canada might suffer some loss in its terms-of-trade under bilateral free trade.[31] A loss in terms-of-trade would reduce the stimuli to output and employment;

Second, in the CANDIDE Model, export and import equations are not disaggregated by country. As a result, the negative trade diversion effects are not captured by the free trade simulations. As mentioned in Section II, since a very large proportion (over 75 per cent) of Canadian trade is currently conducted with the U.S. trade diversion costs (increased cost of imports) are expected to be fairly small;[32]

Finally, unlike the general equilibrium (GE) models, macro-econometric models such as CANDIDE do not fully incorporate the long-term supply constraints on the Canadian economy. For example, in the GE models, the unemployment rate is assumed to remain constant at the base case level in the long term. As a result, most of the benefits of free trade are reflected in increased productivity and real incomes, with no impact on overall employment. In contrast, in the CANDIDE Model 3.0, improvements in real income increase the level of employment and the size of the labour force. Moreover, the increases in employment are larger than the additions to the labour force, putting downward pressure on the unemployment rate. Of course, substantial reductions in the unemployment rate would put upward pressure on

wages and prices and bring the economy to its long-run equilibrium (the full employment unemployment rate). One could argue that the full employment unemployment rate implicit in the CANDIDE Model (around 5.5 per cent in 1995) is on the low side. Therefore, the estimated effects of free trade on output and employment might be somewhat on the optimistic side.

In summary, there is every reason to believe that the estimated impacts of Canada-U.S. free trade are reasonable. There are risks on the upside as well as on the downside. Whether they will cancel each other out or not is difficult to say. What is important is the character of the results. These simulation results strongly suggest that Canada-U.S. free trade will provide significant benefits to all Canadians. It is interesting to note that our estimated impacts fall in the middle of the range of available estimates from other models: 1.3 to 7.0 per cent increase in real income.[33] It is difficult to conceive of any other economic policy that would provide such gains, without imposing a huge cost on future generations. Furthermore, our base case does not take into account any possible loss in output and employment from further (potential) deterioration in Canadian access to the U.S. market.[34] The recent adoption of two tougher trade bills (H.R.3 and S.490) by the U.S. Congress, which are riddled with protectionist measures, could seriously jeopardize our exports to that country. Some of the provisions of these bills, if enacted, could provoke more American countervailing and antidumping trade actions against Canadian exports and thus

contribute to the deterioration of our bilateral trade relations with the United States.

NOTES

1 For more details, see Cline (1982), and Hufbauer and Schott (1985).

2 See Koyal Commission (1985) and Lipsey and Smith (1985).

3 See ECC (1975, 1983 and 1986).

4 See Daly (1984), ECC (1975) and Wonnacott and Wonnacott (1967).

5 See Hazledine (1984), Whalley (1984), Stern (1985) and Wigle (1986).

6 See Lipsey and Smith (1985).

7 See Eastman and Stykolt (1967), ECC (1975), Lipsey and Smith (1985), Harris and Cox (1984), Wonnacott (1975) and Whalley and Hill (1985).

8 For a good discussion of the sources of gains from trade, see Deardorff and Stern (1985), Harris and Cox (1984), Brown and Stern (1987), and Wonnacott (1987).

9 On this point, see Wonnacott (1985).

10 For example see Baldwin (1976).

11 Examples of the general equilibrium approach are, Whalley (1985), Deardorff and Stern (1985), Harris and Cox (1984), and Williams (1976).

12 Informetrica Ltd. (1985), Dungan (1985), and ECC (1976) have used the macro-econometric models to assess the impact of free trade on the Canadian economy.

13 For a detailed description of the dynamic properties of CANDIDE Model 3.0, see "Dynamic Resource of CANDIDE Model 3.0 to Monetary and Fiscal Shocks", Economic Council of Canada, 1985 (Mimeo).

14 In December 1986, the Canadian government agreed to impose an export tax on softwood lumber in order to forestall a pending countervail duty of similar magnitude. This export tax is treated as a countervailing duty for the purpose of this paper.

15 A brief description of the methodology used for computing the tariff equivalents of standard NTBs is given in Appendix B-3.

16 For a brief description of the methodology, see Appendix B-4.

17 For a good discussion of the shortcomings of the subsidies code, see Tarullo (1983).

18 It should be noted that our agricultural subsidy calculations (PSEs) capture the effect of total protection (including standard NTBs and tariffs) provided to the domestic producers. For details, see Appendix B-5.

19 See Walters (1968), West (1971), Daly, Keys, and Spence (1968) and Wonnacott ;(1975).

20 For a detailed discussion of this agreement, see Wonnacott (1975) ECC (1975), Lipsey and Smith (1985), Baldwin and Gorecki (1986), and Wonnacott (1987).

21 For a good discussion of the productivity gap and scale economies debate, see Rao (1987).

22 The application of PPPs for international comparisons of real income is closely associated with the pioneering work of Irving Kravis and his colleagues at the University of Pennsylvania. For a good description of the PPP's rate and its construction, see Ward (1975).

23 For a good description of various types of scale economies, see Silberston (1972), Daly (1984 and 1987) Daly and MacCharles (1986), and Lipsey and Smith (1985).

24 See Daly (1982), Daly and MacCharles (1986), ECC (1983) OECD (1986), and Bank of Canada (1987).

25 See Rao (1987).

26 For a good discussion on the weighting procedures, see Hulten (1978), Joregenson (1980), and Rao and Preston (1984).

27 For a good discussion of the pricing behavior of the domestic firms under various assumptions, see Eastman and Stykolt (1967), Hazledine (1985, 1987), and Karikari (1985).

28 Estimates of percent improvements in total factor productivity (cost saving), based on gross output, are converted into net output (valued added) basis by mutiplying them with the ratio of gross output to value added (industry specific). Changes in manufacturing sector outputs (constant adjustments) are computed by multiplying the base case sector output (value added) levels with the implied percent changes in total factor productivity (value added).

In the CANDIDE Model 3.0, person hours worked respond to changes in sector outputs. Whereas total factor productivity improvements imply no direct change in person hours worked. To offset the additions to person hours worked, we had to

introduce downward constant adjustments to sector-hours equations. These adjustments to person hours worked are computed in accordance with percent changes in sector outputs (value added), base case person hours worked (sector specific) and the CANDIDE output elasticities in person hours equations. Consequently, productivity improvements do not increase employment directly.

29 It should be noted that the direct effects of a free trade agreement would be positive and sizeable in the case of the wood and primary metals industries.

30 The aggregate effects on output and employment in the two scenarios are very similar to the results reported in the 23rd Annual Review. Small differences between the two sets of results arise from data revisions with respect to tariff, non-tariff barriers, and specific estimates of productivity gains within each industry.

31 See Brown and Stern (1986) and Wigle (1986).

32 Our calculations suggest that a bilateral free trade between the U.S. and Canada could increase the U.S. share in total Canadian imports from about 75.0 per cent (base case) to around 77.0 per cent. Similarly, the Canadian share in total U.S. imports will also increase.

33 See Lipsey and Smith (1985).

34 For example, the protectionism simulation results in ECC (1986) suggest a substantial loss in output and employment (about 5 per cent by 1995) from a significant deterioration in world trading system, induced by rising protectionism in the U.S. (a 20 per cent surcharge on most manufactured goods entering the U.S.).

APPENDIX A

SIMPLIFIED STRUCTURE OF CANDIDE MODEL 3.0

CANDIDE Model 3.0 is a large-scale annual macro-econometric model of the Canadian economy estimated using annual time-series data from 1954 to 1981. It contains 2,390 endogenous variables, with 825 stochastic equations. A detailed breakdown of these variables, by sector, is given in Table A-1. A perpetual and salient concern of the large-scale econometric model builder is an effective and cognate portrait of the fundamental structure and characteristics of the system of equations created. Clearly, as a result of the sheer size of CANDIDE Model 3.0, a detailed exposition of the complete system would be inappropriate as such technical discussions would not provide the clear and simple understanding necessary for those not associated or familiar with model building. We have, therefore, developed a textbook-like caricature of this mammoth model to allow an appreciation of the integration of the real and financial sides of the model. This representation captures the major structural and behavioural relationships, abstracting the sector disaggregation incorporated in the actual model. This caricature is represented as the 55-equation model portrayed below, the exposition of which will indicate where the portrait deviates from the actual model.

Table A-1

CANDIDE Model 3.0 - Summary of Equations

Sector	Stochastic	Identities	Total
I Final Demand	223	275	498
(A) Consumption	46	15	61
(B) Nonresidential Business Investment	76	16	92
(C) Residential Investment	9	18	27
(D) Government Investment	17	15	32
(E) Capital Stock Private & Government	0	116	116
(F) Inventory Change	6	17	23
(G) Government (Current Goods and Services)	0	41	41
(H) Exports	37	22	59
(I) Imports	32	15	47
II Sector Outputs	44	65	109
III Labour Supply and Labour Demand	117	98	215
(A) Man-hours	34	8	42
(B) Average Weekly Hours	35	7	42
(C) Employment	1	41	42
(D) Labour Force and Demography	47	42	89
IV Wages, Prices and Nominal Quantities	234	765	999
(A) Wages	37	49	86
(B) Sector Prices	44	65	109
(C) Consumption Deflators	47	117	164
(D) Investment Deflators	74	108	182
(E) Government Expenditure Deflators	23	134	157
(F) Export Prices	2	98	100
(G) Import Prices	3	85	88
(H) Other Deflators	4	109	113
V User Cost of Capital	0	221	221

Table A-1 (cont'd)

Sector	Stochastic	Identities	Total
VI Government Sector	159	78	237
(A) Expenditure	77	27	104
(B) Revenue	82	51	133
VII Nonwage Income, Net Net National Income and Personal Disposable Income	9	18	27
VIII Financial	39	45	84
(A) Assets of the Non-financial Public	10	5	15
(B) Debt Structure of the Government Sector	6	12	18
(C) Interest Rates	10	0	10
(D) Mortgage Activity	6	1	7
(E) Capital Flows and the Exchange Rate	7	27	34
Total	825	1565	2390
Plus Exogenous Variables			1046
Total Variables			3436

Final Demand

Equations (1) to (11) summarize the determination of final demand in constant dollars. The consumption function of our basic model, represented in equation (1), typifies the basic functional relationship between the dependent and the independent variables exhibited by the 46 individual stochastic consumption equations. In contrast to CANDIDE Model 2.0, total personal savings are derived residually. In CANDIDE Model 3.0, the major determinants of consumer expenditure are the real personal disposable income (subtracting the inflation premium), real interest rates, certain demographic variables and the uncertainty associated with inflation and unemployment. Inflation premium adjustment is computed as the product of the stock of government debt and the expected inflation. Relative prices and the age-sex distribution of the population play a key role in the determination of the composition of total consumer expenditure.

The investment functions are the traditional Jorgenson type, augmented by the capacity utilization and cashflow variables. In CANDIDE, investment is disaggregated by 44 industrial sectors and by construction and machinery and equipment. A user cost variable is computed by sector and by type, using information on the industrial bond yield, required rate of return on equity, debt-equity ratio, price of investment, effective tax rates, expected inflation, depreciation rates, tax credits and capital cost allowances. In CANDIDE Model 3.0, investment equations in

general depend upon sector specific output, output price, lagged capital stock, proxies for capacity utilization and cashflow, and the rental price of capital (user cost of capital). The essential nature of these relationships is captured in our simplified model (equation (2)), where investment is a function of output (Y), relative price (P_Y/P_I), industrial bond yield (r_L), effective tax rate (τ_c), required rate return on equity (r_E), inflationary expectations ($\dot{P}^e$), capacity utilization (Y/Y^*), cashflow position ($CASH\$/P_Y$) and the lagged capital stock(K(-1)). The interest rate in this specification, of course, represents the traditional Keynesian cost of capital channel.

Capital stock is created within CANDIDE at the 44-sector level and disaggregated into machinery and equipment and structures to correspond to investment. This is done by cumulating investment while depreciating the existing capital stock at its respective industry-specific depreciation rate (δ). This is captured for our simple model in equation (3).

Investment in residential construction is determined by modeling the total and single housing starts, and completions, and then relating investment expenditure on single, multiple and others to these variables via linking equations. Our simplified model captures the essence of this system in equations (4) and (5). The major determinants of housing starts are the real disposable income (Y_d/P_C), mortgage approvals (MAP/P_Y) reflecting the credit

availability channel, working age population (POP_{15+}), real mortgage interest rate ($r_{MORT} - \dot{P}^e$) and the existing housing stock (HSTOCK(-1)).

In CANDIDE Model 3.0, government current expenditure on goods and services is exogenous. However, government investment responds to changes in economic activity, unemployment picture and the wear and tear associated with the existing capital stock ($K_G(-1)$) - see equations (6)and (7).

Like CANDIDE Model 2.0, the new model has inventory change equations for manufacturing durables, nondurables, forestry, mining, wholesale and retail trade, and other industries, which when combined with the lagged stocks, determine the inventory levels. The structure of this block is captured in equation (8) of our simplified model. Inventory change reacts to variations in sales (Y), capacity utilization (Y/Y^*), real interest rate ($r_S - \dot{P}^e$) and the lagged stock (INV(-1)).

The many equations of the foreign trade sector are collapsed into two behavioural relationships in our simplified model (equations (9) and (10)), yet these capture the essence of the actual relationships. Exports primarily depend upon foreign activity variables (Y_{US},Y_{RW}), and their composition (I_{US}/Y_{US}),

relative prices ($\frac{P_F}{P_Y}$, $\frac{P_F}{P_E}$), the exchange rate (REXCAN), interest rates ($\underset{\sim}{r}$) and the stock, as well as the composition, of Canadian debt held by the foreigners ($DEBT_C^F$). Similarly imports depend on economic activity at home (C, I_B), the composition of domestic demand ($\frac{I_B}{Y}$), relative prices (P_F/P_Y), the exchange rate (REXCAN), interest rates in the U.S. (r^{US}) and the stock of foreign debt held by Canadians and its composition ($DEBT_F^C$).

Substitution of expressions (1) to (10) into (11) gives the familiar IS curve. This completes the determination of the demand side of the model.

Industrial Output

As mentioned before, CANDIDE Model 3.0 can be viewed as a collection of industry models, each of which includes an equation for investment (construction and M&E separately), person-hours, average weekly hours, employment, productivity, wages, sector prices, imports and exports.

Real activity at the industrial level (either manufacturing or non-manufacturing) plays a key role in the determination of investment, employment, unemployment, productivity, and the real wage. The final demand components of the model, aggregated in the

about 160 categories, are transformed using the 1978 input/output relationships to industrial output.

Using fixed coefficients, the conversion method leaves systematic biases in the estimate of industry output if we do not account for variations in the mix of inputs and outputs due to changes in relative prices, tastes, age-sex composition of the population and technology. To account for both secular and cyclical changes in the I-O coefficients, regression techniques are used to model the discrepancies between a fixed coefficient estimate of output and the observed data.

Labour Supply and Labour Demand

Labour supply is modeled in the demographic sector. The CANDIDE model incorporates the endogenous determination of population segmented by age (5-year cohorts) and sex. Various aggregations of these cohorts provide the source populations for obtaining both labour force and births by specific age groups. Births are endogenously determined as the product of the female source population of child-bearing age and the associated birth rates, the latter of which are also modeled endogenously. Labour supply is determined as the sum of the product of seven different endogenously-determined participation rates and their corresponding source populations. The participation rate of the simplified model (equation (12)) preserves the basic functional relationships of CANDIDE Model 3.0, where the aggregate

participation rate primarily depends on the unemployment rate (URATE), availability of jobs (N/POP_{15+}), share of service sector employment (NSV/N), children under age 6 (CWR), university enrolment rate (ENROL), real after-tax wage ($\frac{W}{P_C}(1 - T_P)$), real pension benefits $(\frac{PEN\$}{P_C})/(POP_{65+})$ and the age-sex composition of the working-age population.

The person-hours equations represented by equation (14) are the derived demand functions for labour input of the CES production function. They are driven by output (Y), relative prices ($\frac{W}{P_Y}$, W/P_e, W/P_I) and a time trend to obtain the technical progress parameter.

The hours equations are primarily determined by a sector-specific real wage and capacity utilization proxy, the macro-unemployment rate, and a time trend to capture secular trends in the data. Deviations from the trend are influenced by slack in the labour market (URATE), sector-specific capacity utilization variable (Y/Y^*) and the real wage rate ($\frac{W}{P_Y}$). Combining the results of equations (14) and (15), dividing person-hours by hours, gives us employment.

Wages and Prices

The aggregate wage rate is determined as a weighted sum of sectoral wage rates. The sectoral breakdown follows that of output conversion, person-hour demand, etc. These equations, exemplified by equation (20), are simple inflation-augmented Phillips curves where the percentage change in wage rates is a function of labour market tightness variable - the unemployment rate of males aged 25-54 (MURATE), inflationary expectations ($\dot{P}^e$) and the trend productivity growth ($\dot{PROD}$). In CANDIDE Model 3.0, inflationary expectations (equation (19)) are modeled as a function of the past year's inflation rate and the percentage change in the money supply ($\dot{M}$) over the past two years. This innovation allows expectations to be formed by a more 'rational' process than does the traditional approach of a weighted sum of the past inflation rates.

Wage rates in turn are used as an important input in the determination of final demand prices, including the CPI. Final demand price determination consists of four parts:
(1) determination of sector prices (value-added deflators);
(2) conversion of sector prices, using the 1978 input/output relationships, namely, the use matrix, the market share matrix, import content (by industry) of total domestic supply and the import prices; (3) conversion of these pseudo commodity prices into pseudo final demand prices using the commodity composition of

final demand (the bridge matrix) and a number of indirect tax rates; and (4) adjustment of these pseudo final demand prices for the errors which result from using a constant coefficient input-output framework.

The determination of sector prices is represented by equation (21) of our simplified model. Each sectoral value-added price is influenced by sector specific wage rates (W), productivity (PROD) and capacity utilization measures (Y/Y^*), occasionally supplemented by by long-term interest rate (r_L) - cost of capital, and the labour market tightness variable (MURATE). Equations (22) to (26) are meant to portray "price conversion", again a considerable abstraction from the real process underlying it. It is easier to think of final demand prices as a weighted average of value-added prices and import prices, where weights are the import content of that particular commodity. In contrast to CANDIDE 2.0, in the new model, the import-content vector varies in response to variations in relative prices. In sum, final demand prices are determined by sector prices, import prices, indirect taxes, capacity utilization and a time trend to capture long-term trends in the input-output coefficients. The trade prices (import and export) in Canadian dollars are obtained by multiplying the foreign prices by the endogenously-determined exchange rate (equations (22) and (23)).

Government Revenue & Expenditure

As mentioned before, constant dollar government expenditures on goods and services are exogenous to the model. Current dollar spending on goods and services is derived through the use of appropriate identities linking prices, endogenously determined (wages), and their corresponding quantities to constant dollar expenditure. Total current dollar expenditure by level of government is obtained by adding spending on transfers, subsidies, and debt servicing to spending on goods and services.

Transfers constitute a major portion of government expenditure. In the aggregate, these transfers are determined by summing those which originate with the Canada and Quebec Pension Plan and spending specifically related to other federal, provincial, and local transfer programs. At the federal, provincial and local level many transfer expenditures are determined at the level of the specific program, using rate-base techniques. For example, at the federal level, family and youth allowances are influenced both by demographic factors (cohort information) and the benefit rates applicable to the cohorts in question. Similarly, World War I and II Pension Benefits, War Veteran's Allowances, Unemployment Insurance Benefits and Old Age Security Payments are determined through appropriate rate-base specifications. Expressions (27) and (28) are an over-simplification of the many separately *modeled* transfer activities for each level of government. However, they do include the major factors which influence government transfer

activity such as the inflation rate to which many benefit rates are tied by legislation.

Interest paid by governments is influenced by the level and composition of outstanding debt and by the appropriate interest rates. Movements in the exchange rate also play a role if part of the debt is denominated in U.S. dollars (equations (29) and (30)). This component of government expenditure is crucial to consistent modeling of the government financing decision. The government budget constraint is structurally modeled and links fiscal and monetary policy. The linkages in the model between the real and financial accounts ensure that increases in government debt do influence interest payments in the future. In CANDIDE Model 3.0 subsidies are treated exogenously.

Equations (32) and (33) are simplifications of the major determinants of government revenue. Government revenue by level of government is determined through a detailed set of rate-base calculations. These are as simple as those used to determine corporate taxes where an aggregate corporate profits tax rate is applied to a base determined on the income side of the model or are as complicated as the tax calculator which is used to estimate personal tax collections associated with income tax. In simple terms, however, revenues within the government sector can be characterized as rate-base calculations, where both rates and bases are determined by budget procedures outlined by federal, provincial and municipal governments.

Personal Income

Personal income, expression (40), plays a critical role in any model. It is a major determinant of consumption, it influences government revenues and its components are influenced partly by labour markets (wage rate and employment activity), financial markets (interest payments) and government income support programs (transfer payments). We have previously indicated what influences wage rates, person-hours and government transfer payments. Interest income to the to the personal sector is an additional route through which the financial sector influences the real side of the economy. Personal interest income depends upon interest rates and the stock of financial assets held by the nonfinancial public (equation (38)). In the model there are direct links between government deficits and the flow of interest income to the personal sector. In the personal income identity there are some remaining items, such as farm income, dividends and income from non-farm unincorporated businesses. These components of personal income are influenced by real activity and price levels associated with the sector within which the income base is generated.

Financial Sector

CANDIDE Model 3.0 explicitly incorporates the budget constraints of all levels of government. This in turn enables us to include all the important feedbacks between the real and financial sectors of the system. The following six blocks constitute the financial

sector of CANDIDE Model 3.0: (a) debt-portfolio model, (b) asset-portfolio model, (c) earning assets of chartered banks, (d) mortgage model, (e) term structure of interest rates, and (f) exchange rate and capital flows.

The debt-portfolio model determines both the level and composition of federal government debt in each period. Both the federal deficit (including the loans to Crown corporations) and the balance on the exchange fund account play a key role in determining the net additions to the stock of federal debt (see equations (43) and (44)).

In the new CANDIDE Model, the net additions to financial assets of the nonfinancial public are primarily influenced by the level of personal savings and the inflation rate. The inflation rate is intended to capture the changes in financial assets associated with capital gains or capital losses (see equation (39)).

Given the interest rate vector, real income, prices, and the total financial assets, the asset-portfolio model determines the composition of assets of nonfinancial public. In view of its vital role in the determination of interest rates and nominal income, the money demand function (M^D) is separated from the asset-portfolio model. As in the case of the other macro-models, in CANDIDE 3.0 demand for money is a function of real income, the price level, the interest rate and a time trend (equation (46)).

The time trend is used to capture secular shifts in the money demand function.

Equations (47), (48) and (49) are the three important rates of the term structure model. As in CANDIDE 2.0, in the new model the central short rate (90-day finance company paper rate) is modeled as a reaction function of the Bank of Canada. The Bank is assumed to react to changes in the U.S. short rate, inflationary expectations and the financial assets of the nonfinancial public in relation to nominal GNP (see equation (47)). If the Bank of Canada is assumed to follow pure monetary targeting, irrespective of its implications for interest rates and the exchange rate, money supply is policy determined. Consequently, the money demand function (equation (46)) is solved for the central short-term interest rate. Long rates in the model are determined as a function of the central short rate, the U.S. long rate and the stock of government debt in relation to nominal GNP. This is captured in equation (48) of our simplified model. In the CANDIDE Model, the mortgage rate also depends on the supply of mortgage approvals and is influenced by the variables which determine the demand for mortgages, HSTOCK(-1),POP_{15+}) - see equation (49).

In the mortgage model, mortgage approvals of various financial institutions are modeled. Mortgage approvals of each financial institution in general are determined as a function of the existing stock of mortgage approvals, the mortgage rate relative to the long-term government bond rate, and its total assets (as

determined by the asset portfolio model). The mortgage approvals (equation (50)) represent the mortgage market model.

The asset composition of nonfinancial public in conjunction with the primary and secondary reserve requirements (as required by the Bank of Canada) determined the earning assets of chartered banks and high-powered money (monetary base).

Equations (51) to (55) represent the capital flows and the exchange rate block of the financial sector. In CANDIDE Model 3.0, long-term capital flows (equation (51)) respond to changes in long-term interest rate differentials ($r_L - r_L^{US}$), the investment and savings picture both in Canada and the U.S. (((IB*P_I) - DS\$),(I\$^{US}-DS\$^{US})) and the budget position of the provincial governments. The exchange rate (equation (53)) moves in response to changes in the expected exchange rate, (REXCANEXP), short-term interest rate differentials ($r_S - r_S^{US}$), and the basic balance (relative to the economic activity). The expected exchange rate (equation (52)) in turn depends on the expected differentials in the inflation rate ($\dot{P}^e - \dot{P}^e_{US}$) and the lagged value of the exchange rate (REXCAN). Equations (54) and (55) describe the determination of the current account balance and the basic balance, respectively.

Simplified Structure of CANDIDE Model 3.0

A. Final Demand

(1) Consumption Function

$$C = C[(Y_d^{*}\$/P_C),\ (r_S - \dot{P}^e),\ \Delta URATE,\ DEM,\ C(-1)]$$

(2) Nonresidential Business Investment Function

$$I_B = I_B[Y(L),\ (P_Y/(P_I\ (r_L(1-\bar{\tau}_C)) - \dot{P}^e)),\ \bar{r}_E,\ Y/Y^{*},\ (CASH\$/P_Y)(L),\ K(-1)]$$

(3) Capital Stock, Business Sector

$$K = (1-2\bar{\delta})K(-1) + I_B$$

(4) Housing Starts

$$HS = HS[(Y_d^{\$}/P_C)(L),\ (MAP/P_Y)(L),\ POP_{15+},\ (r_{MORT} - \dot{P}^e)(L),\ HSTOCK(-1)]$$

(5) Residential Investment

$$I_R = I_R[HS(L),\ Y_d^{\$}/P_C(L)]$$

(6) Government Investment

$$I_G = I_G[Y(L),\ URATE(L),\ K_G(-1)]$$

(7) Capital Stock, Government Sector

$$K_G = (1-2\bar{\delta}_1)\, K_G(-1) + I_G$$

(8) Inventory Change

$$.INV = .INV[Y(L),\ (Y/Y^*),\ (r_S - \dot{P}^e)(L)\ INV(-1)]$$

(9) Exports

$$EX = EX[\bar{Y}_{US}(L),\ \bar{Y}_{RW}(L),\ (\bar{I}^{US}/\bar{Y}_{US}),\ (\frac{P_F}{P_Y})(L),\ \frac{P_F}{P_E}(L),\ \underset{\sim}{r},\ DEBT^F_C,\ REXCAN]$$

(10) Imports

$$IM = IM[C(L),\ (I_B/Y),\ (P_F/P_Y)(L),\ \underset{\sim}{r}^{US},\ DEBT^C_F,\ REXCAN]$$

(11) GNE Identity

$$Y = C + I_B + I_G + \overline{GE}_F + \overline{GE}_{P+O} + I_R + .INV + EX - IM$$

B. Labour Supply and Labour Demand

(12) Participation Rate

$$PR = PR[URATE(L),\ ENROL(L),\ UID,\ CWR(L),\ \frac{W}{P_C}(1-\tau_p)(L),$$
$$((PEN\$/P_C)/POP_{65+})(N/POP_{15+}),\ (NSV/N)]$$

(13) Labour Force

$$LF = POP_{15+} * PR$$

(14) Man-hours

$$MH = MH[Y(L),\ (\frac{W}{P_Y})(L),\ (\frac{W}{P_e})(L),\ (\frac{W}{P_I})(L),\ t]$$

(15) Average Weekly Hours

$$H = H[(\frac{W}{P_Y})(L),\ (\frac{Y}{Y^*}),\ URATE,\ t]$$

(16) Employment

$$N = MH/(H * 52.0)$$

(17) Unemployment Rate

$$URATE = (LF-N)/LF$$

(18) Prime Age Male Unemployment Rate

$$MURATE = MURATE[URATE(L),\ (MLF/LF)(L)]$$

C. Wages and Prices

(19) Inflationary Expectations

$$\dot{P}^e = \dot{P}^e[\dot{P}_C(-1), \dot{M}(L)]$$

(20) Hourly Wage Rate

$$\dot{W} = \dot{W}\,[\text{MURATE}, \dot{P}^e, \text{PROD}]$$

(21) GDP Deflator

$$P_Y = P_Y[W(L), \text{PROD}(L), r_L(L), (Y/Y^*), \text{MURATE}]$$

(22) Export Deflator

$$P_E = \bar{P}_E^* * \text{REXCAN}$$

(23) Import Deflator

$$P_F = \bar{P}_F^* * \text{REXCAN}$$

(24) Consumption Deflator

$$P_C = P_C[P_Y, P_F, \bar{\tau}_S, t, \frac{Y}{Y^*}]$$

(25) Investment Deflator

$$P_I = P_I[P_Y, P_F, \bar{\tau}_S, t, \frac{Y}{Y^*}]$$

(26) Government Expenditure Deflator

$$P_G = P_G[P_Y, P_F, \bar{\tau}_S, t, \frac{Y}{Y^*}]$$

D. Government Sector

(27) Federal Government Transfers to Persons

$$GE_{TP.F\$} = GE_{TP.F\$}[(URATE * LF), P_C(-1), B.\overline{RATE}_F]$$

(28) Transfers to Persons - Other Levels of Government

$$GE_{TP.P+O}{}^{\$} = GE_{TP.P+O}{}^{\$}[(URATE * LF), P_C(-1), B.\overline{RATE}_{P+O}]$$

(29) Interest Payments, Federal

$$GE_{INT.F}{}^{\$} = GE_{INT.F}{}^{\$}[DEBT_F, \xi, REXCAN]$$

(30) Interest Payments, Other Levels of Government

$$GE_{INT.P+O}{}^{\$} = GE_{INT.P+O}{}^{\$}[DEBT_{P+O}, \xi, \xi^{US}, REXCAN]$$

(31) Federal Transfers to Other Levels of Government

$$GE_{TP+O.F}{}^{\$} = GE_{TP+O.F}{}^{\$}[Y^*P_Y]$$

(32) Total Revenue Federal

$$GTR_F\$ = \bar{\tau}_{PF}(Y\$) + \bar{\tau}_{CF}\Pi + \bar{\tau}_{SF}(C * P_C) + OTH.R_F\$$$

(33) Total Revenue - Other Levels of Government

$$GTR_{P+O}\$ = \bar{\tau}_{PP+O}(Y\$) + \bar{\tau}_{CP+O}\Pi + \bar{\tau}_{SP+O}(C * P_C) + GE_{TP+O.F}\$ + OTH.R_{P+O}\$$$

(34) Total Expenditure, Federal

$$GTE_F\$ = (\overline{GE}_F * P_G) + \overline{GE}_{TP.F}\$ + GE_{TP+O.F}\$ + GE_{INT.F}\$ + \overline{GE}_{SUB.F}\$$$

(35) Total Expenditure, Other Levels of Government

$$GTE_{P+O}\$ = (\overline{GE}_{P+O} * P_G) + GE_{TP.P+O}\$ + GE_{INT.P+O}\$ + \overline{GE}_{SUB.P+O}\$$$

(36) Deficit, Federal

$$GDF\$ = GTE_F\$ - GTR_F\$$$

(37) Deficit, Other Levels of Government

$$GDP+O\$ = GTE_{P+O}\$ - GTR_{P+O}\$$$

E. Personal Disposable Income

(38) Personal Interest Income

$$INT_p = INT_p[\underset{\sim}{A}, \underset{\sim}{r}]$$

(39) Assets of Nonfinancial Public

$$A = A[S\$, \dot{P}_Y, A(-1)]$$

(40) Personal Income Identity

$$Y\$ = (W * MH) + INT_P + GE_{TP.F}\$ + GE_{TP.P+C}\$ + \overline{OTH\$}$$

(41) Personal Disposable Income

$$Y_d^{\$} = Y\$ - \tau_{PF} Y\$ - \tau_{PP+O} Y\$$$

(42) Personal Savings

$$S\$ = Y_d^{\$} - (C * P_C) - INT.CD\$ - IP.A\$$$

F. Financial Sector

(43) Financing Requirements of the Federal Government

$$\dot{DEBT}_F = GDF\$ + \overline{BALOFS\$} + (\overline{DEP\$} - \overline{DEP\$}(-1)) + \overline{REST\$}$$

(44) Stock of Debt, Federal

$$DEBT_F = DEBT_F(-1) + \dot{DEBT}_F$$

(45) Stock of Debt, Other Levels of Government

$$DEBT_{P+O} = DEBT_{P+O}(-1) + GDP+O\$$$

(46) Demand for Money by the Public

$$M^D = M^D(Y, r_S, P_Y, t)$$

(47) Short Rate

$$r_S = r_S[r_S^{US}, \dot{P}^e, A/(Y * P_Y)]$$

(48) Long Rate

$$r_L = r_L[r_S(L), r_L^{US}, DEBT_F/(Y * P_Y)]$$

(49) Mortgage Rate

$$r_{MORT} = r_{MORT}[r_L, (\frac{MAP}{P_Y}), HSTOCK(-1), POP_{15+}]$$

(50) Mortgage Approvals

$$MAP = MAP[MAP(-1)(L), (r_{MORT}/r_L), A.FI]$$

(51) Long-term Capital Flows

$$CAPF_L = CAPF_L[(r_L - r_L^{US}), ((I_B * P_I) - DS\$), (\overline{I}^{US}\$ - \overline{DS}^{US}\$), GDP+0\$]$$

(52) Expected Exchange Rate

$$REXCANEXP = [REXCAN(-1)\ (1 + (\dot{P}^e - \dot{\overline{P}}^e_{US}))]$$

(53) Exchange Rate Equation

$$REXCAN = REXCAN[REXCANEXP, (r_S - \bar{r}_S^{US}), (BBAL/(Y^*P_Y))]$$

(54) Current Account Balance

$$CABAL = (EX * P_E) - (IM * P_F) + NETTFR_I$$

(55) Basic Balance

$$BBAL = CABAL + CAPF_L$$

Addendum

Personal Disposable Income Adjusted for Inflation Premium, $

$$Y_d^{*}\$ = Y_d^{\$} - INT.CD\$ - IP.A\$ - ((\dot{P}^e * (A^*(-1) + (0.5 * \Delta A^*)))/100.0)$$

Productivity (Output per man-hour)

$$PROD = Y/MH$$

Inventory Stock, Constant $

$$INV = INV(-1) + .INV$$

Short-term Capital Flows, $

$$CAPF_S = \overline{BALOFS\$} - BBAL$$

Definition of the Variables

A = Total Financial Assets of the nonfinancial public, $

A.FI = Total assets of the financial institutions, $

A^* = Net Financial Assets of the Personal Sector

$B.RATE_F$ = Benefit Rate, Federal

$B.RATE_{P+O}$ = Benefit Rate, Other Levels of Government

BALOFS$ = Official Settlement Balance, $

BBAL = Basic Balance, $

C = Consumer Expenditure, Total - Constant $

CABAL = Current Account Balance, $

$CAPF_L$ = Long-term Capital Flows, $

$CAPF_S$ = Short-term Capital Flows, $

CASH$ = Retained Earnings of the Corporate Sector, $

CWR = Child-woman Ratio

$DEBT_F$ = Total stock of Debt-Federal, $

$DEBT_{P+O}$ = Total Stock of Debt - Other Levels of Government, $

$DEBT_C^F$ = Total Stock of Canadian Debt held by the Foreigners, $

$DEBT_F^C$ = Total Stock of Foreign Debt held by Canadians, $

DEM = Demographic Variables

DEP$ = Federal Government Deposits with Financial Institutions, $

DS$ = Total Domestic Savings Canada - $

$DS^{US}\$$ = Total Domestic Savings, U.S. - $

ENROL = School & University Enrolment Rate

EX = Exports of Goods & Services, Total - Constant $

GDF$ = Deficit, Federal, $

GDP+0$ = Deficit, Other Levels of Government, $

GE_F = Government Expenditure -- Current Goods & Services, Federal - Constant $

GE_{P+O} = Government Expenditure -- Current Goods & Services, Other Levels of Government - Constant $

$GE_{TP.F}\$$ = Government Transfers to Persons, Federal, $

$GE_{TP.P+O}\$$ = Government Transfers to Persons, Other Levels of government, $

$GE_{INT.F}\$$ = Interest Payments, Federal, $

$GE_{INT.P+O}\$$ = Interest Payments, Other Levels of Government, $

$GE_{TP+O.F}\$$ = Federal Transfers to Other Levels of Government, $

$GE_{SUB.F}\$$ = Subsidies & Capital Assistance, Federal, $

$GE_{SUB.P+O}\$$ = Assistance, Other Levels of Government, $

$GTR_F\$$ = Total Government Revenue, Federal, $

$GTR_{P+O}\$$ = Total Government Revenue, Other Levels of Government, $

$GTE_F\$$ = Total Expenditure, Federal, $

$GTE_{P+O}\$$ = Total Expenditure, Other Levels of Government, $

H = Average Weekly Hours

HS = Housing Starts

HSTOCK = Housing Stock

I_B = Capital Formation - (Nonresidential), Business - Constant $

I_G = Government Investment - Constant $

I_R = Residential Investment - Constant $

I^{US} = Investment Expenditure - U.S., Constant $

$I^{US}\$$ = Investment Expenditure - U.S. $

INT_P = Interest and Investment Income - Personal Sector, $

IM = Imports of Goods & Services - Constant $

INT.CD$ = Interest on Consumer Debt, $

.INV = Inventory Change - Constant $

INV = Inventory Stock - Constant $

IP.A$ = Net Personal remittances to Foreign Residents, $

K = Total Capital Stock, Business - Constant $

K_G = Capital Stock, Government - Constant $

LF = Total Labour Force

M = Money Supply, $

MAP = Total Mortgage Approvals, $

M^D = Demand for Money, $

MH = Total Man-hours

MLF = Prime Age Male Labour Force

MURATE = Prime Age Male Unemployment Rate

N = Total Employment

$NETTFR_I$ = Net International Transfers

NSV = Service Sector Employment

OTH$ = Other Income of the Personal Sector, $

$OTH.R_F\$$ = Other Revenue, Federal Government, $

$OTH.R_{P+O}\$$ = Other Revenue, Other Levels of Government, $

P_C = Consumer Expenditure Deflator

P_e = Price of Energy

P_E = Export Price in Canadian Currency

P_E^* = Export Price in U.S. Currency

P_F = Import Price in Canadian Currency

P_F^* = Import Price in U.S. Currency

P_G = Government Expenditure Deflator

P_I = Investment Expenditure Deflator

P_Y = Output Deflator, Total Economy

PEN$ = Pension Benefits - $

POP_{15+} = Total Population, Aged 15 Years and Over

POP_{65+} = Total Population, Aged 65 Years and Over

PR = Participation Rate

PROD = Labour Productivity (Output per man-hour)

$\dot{P}^e$ = Expected Inflation

$\dot{P}^e_{US}$ = Expected Inflation in the U.S.

REXCAN = Exchange Rate in $ Canadian Per Unit of $ U.S.

REXCANEXP = Expected Exchange Rate

r_E = Required Rate of Return on Equity

r_S = Canadian Short Rate

r_S^{US} = U.S. Short Rate

r_L = Canadian Long Rate

r_L^{US} = U.S. Long Rate

r_{MORT} = Mortgage Rate, Canada

REST$ = Other Financing Requirements of the Federal Government, $

S$ = Personal Savings, $

t = Time Trend

UID = Unemployment Insurance Dummy

URATE = Unemployment Rate, Aggregate

W = Average Hourly Earnings

Y = Total Output (GNE) - Constant $

Y^* = A Five Year Moving Average of the Output (GNE)

Y_{RW} = Total Output (GNE) of Countries Other than U.S. and Canada

Y_{US} = Total Output (GNE) of the U.S. Economy

Y$ = Personal Income, $

$Y_d^{\$}$ = Personal Disposable Income, $

$Y_d^{*}\$$ = Personal Disposable Income Adjusted for Inflation Premium, $

τ_C = Corporate Income Tax Rate

τ_P = Personal Income Tax Rate

τ_{PF} = Federal Personal Income Tax Rate

τ_{CF} = Federal Corporate Income Tax Rate

τ_S = Indirect Tax Rates

τ_{SF} = Federal Sales Tax Rate

τ_{PP+O} = Personal Income Tax Rate, Other Levels of Government

τ_{CP+O} = Corporate Income Tax Rate, Other Levels of Government

τ_{SP+O} = Sales Tax Rate, Other Levels of Government

δ = Depreciation Rate, Business Capital Stock

δ_1 = Depreciation Rate, Government Capital Stock

Π = Corporate Profits Before Taxes

Special Notations

$\underset{\sim}{X}$ = A Vector of Variables

$\dot{X}$ = Per Cent Change of the Variables Concerned

ΔX = First Difference of the Variable Concerned

$X(L)$ = A Distributed Lag of the Variable Concerned

$X(-1)$ = Previous Year's Value of the Variable Concerned

$\overline{X}$ = An Exogenous Variable to CANDIDE Model 3.0

APPENDIX B

B.1 Linking CANDIDE Model and Statistics Canada I/O National Model for U.S.-Canada Free Trade Simulation

There are primarily two major features that distinguish CANDIDE Model 3.0 from the StatCan National I/O Model of 1981: 1) the level of aggregation by commodity, industry and final demand categories and 2) the extent of endogeneity of the model (or the extent to which variables are exogenous or endogenous to the model without counting the identities).

The I/O Model has the distinct advantage particularly in levels of disaggregation by industry and commodity. Hence, the level of disaggregation which is considered important for trade simulations has been the primary motivation behind the linking exercise. The endogenous nature of CANDIDE is already described in Appendix A whereas that of I/O is described in Catalogue 15-508E. In the I/O model, there are two versions: a) closed model with only consumption endogenous and b) open model with every behavioural variable exogenous. The I/O model (open or closed) can also be run with two options with regard to imports: 1) import coefficients operative for both direct and indirect impacts, and 2) import coefficients with indirect impacts only. The latter

category can be paraphrased as "open import coefficient" model, which does not allow imports to be sucked in directly. In most trade simulations, to estimate indirect effects from the I/O model we have used the open import coefficient model when shocks are registered, shocks being the responses of CANDIDE model from the trade simulations. Since in a model sense CANDIDE is much more "closed" than I/O, all trade impacts are better realized in CANDIDE (especially for indirect effects) and hence it is appropriate that a recursive route from CANDIDE to I/O by industry/commodity would be a desirable procedure for estimating indirect trade impacts by detailed I/O industry.

We set out to obtain first some benchmark estimates of GDP and employment by I/O 44 industry (medium) consistent with CANDIDE GDP and employment in 1981 and then prorate to 1995. CANDIDE level of aggregation of industry does not have a one-to-one correspondence to I/O (medium) industry in 1981 both in terms of GDP and employment. Hence a correspondence matrix of CANDIDE-I/O is created for both GDP and employment in 1981 by industry such that the aggregate GDP and employment of CANDIDE match I/O counterparts. Thus, for example, I/O employment estimates by industry do not correspond to CANDIDE because CANDIDE uses labour force statistics on employment whereas I/O uses census data for census years but interpolated for other years. Historically, there are also other differences, namely, RDP (real domestic product) and GDP by industry. RDP is used for CANDIDE industries

whereas GDP is for I/O industries. Since CANDIDE provides the base case for trade simulations, all GDP and employment figures in I/O industries (in I/O model, level form) are calibrated to agree to CANDIDE totals in 1981 by suitable matrix form with proportionality assumptions for industries, and then prorated to 1995 CANDIDE levels.

For the various steps in simulating the impact of Canada-US trade in the two scenarios, see Table B-1 where CANDIDE - I/O correspondence is further explained.

The provincial impact of trade simulations is carried out by using two provincial share matrices (national GDP and national employment) which have been created for the year 1981 based on inter-provincial I/O table of 1979. These 1981 share matrices for GDP and employment by provinces are shown in Table B-2 and Table B-3 by five sectors, namely, primarily, manufacturing durables, manufacturing non-durables, construction and services (inclusive of public Administration). The provincial share multiplied by the national growth rate by sector generates the contribution of that sector to the provincial growth trade.

Table B-1

Linking CANDIDE Model 3.0 with the Statistics Canada Input-Output (I/0) Model: Canada-U.S. Free Trade Simulations

Objectives:
1) Statistics Canada National Input-Output Model is used to obtain sufficient industry disaggregation. The direct effects of Canada-U.S. free trade on net exports by 69 commodities are translated into changes in output and employment by industry using the I/0 Model.
2) On the other hand, indirect effects of Canada-U.S. free trade on consumer expenditure, investment, government expenditure on goods and services and inventory change are captured well by the CANDIDE Model. These changes in final demand (excluding net exports) are passed through the I/0 Model to obtain the indirect effects of Canada-U.S. free trade on output and employment by industry in Canada. The sum of direct and indirect effects gives the total effect by I/0 industry.

Simulation 1	Step 1	Step 2	Step 3
Removal of trade barriers (tariffs, and NTBs and federal government discriminatory procurement policies) in two countries.	Direct effects by I/0 industry: Using the information on percent changes in export and import prices (due to the removal of trade barriers), import and export price elasticities and the base case volume of exports and imports (1995), changes in exports and imports by 69 commodities are computed. These changes in net exports are in turn converted into changes in output and employment by I/0 industry.	Indirect effects by I/0 industry: The impact of Canada-U.S. free trade on final demand by commodities (excluding exports and imports) from the CANDIDE Simulation (1995) are passed through the I/0 Model to obtain the indirect effects on output and employment by industry.	Total effects by I/0 industry: These are computed by summing the direct and the indirect effects.

Simulation 2	Step 1	Step 2	Step 3
Removal of trade barriers in the two countries plus improvements in manufacturing productivity due to scale economies and rationalization.	Direct effects by I/0 industry: Using the information on percent changes in export and import prices (due to the removal of trade barriers), import and export price elasticities and the base case volume of exports and imports (1995), changes in exports and imports by 69 commodities are computed. These changes in net exports are in turn converted into changes in output and employment by I/0 industry.	Indirect effects of Canada-U.S. free trade on final demand from Simulation 2 (excluding net exports), from the CANDIDE Model (1995), are passed through the I-0 Model to obtain the indirect effects on output and employment by I/0 industry.	The sum of direct and indirect effects by I/0 industry gives the total effect by I/0 industry.

Table B-2

Per Cent Distribution of Provincial GDP (1981$) by Sector, 1981

Sectors	Nfld.	PEI	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	YWNT	Canada
Primary Industries	14.56	13.41	6.10	8.05	4.18	3.77	9.72	27.98	30.89	11.03	32.53	10.48
Manufacturing - durables	2.18	1.43	4.83	6.66	10.06	16.57	7.45	2.50	3.04	9.92	0.13	10.65
Manufacturing - nondurables	12.90	9.58	13.66	13.01	14.79	12.72	7.93	3.23	3.48	9.47	0.56	10.78
Construction	11.42	9.75	8.15	8.87	7.24	5.55	5.93	8.20	8.69	7.61	18.00	7.01
Services	58.93	65.84	67.26	63.40	63.72	61.38	68.98	58.09	53.89	61.98	48.78	61.07
Total	100	100	100	100	100	100	100	100	100	100	100	100

Percent Distribution of Sector GDP (1981$) by Province, 1981

Sectors	Nfld.	PEI	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	YWNT	Canada
Primary Industries	1.67	0.35	1.18	1.45	8.84	13.36	3.60	10.59	45.42	12.37	1.18	100.00
Manufacturing - durables	0.25	0.04	0.92	1.18	20.91	57.72	2.71	0.93	4.40	10.94	0.00	100.00
Manufacturing - nondurables	1.43	0.24	2.57	2.27	30.37	43.76	2.85	1.19	4.97	10.32	0.02	100.00
Construction	1.95	0.37	2.36	2.38	22.86	29.34	3.28	4.64	19.09	12.74	0.98	100.00
Services	1.16	0.29	2.23	1.96	23.10	37.28	4.38	3.77	13.59	11.93	0.30	100.00

Table B-3

Percent Distribution of Provincial Employment by Sector, 1981

Sectors	Nfld.	PEI	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	YWNT	Canada
Primary Industries	13.20	21.20	11.73	10.32	5.29	5.25	8.63	17.28	13.19	10.30	22.22	7.67
Manufacturing - durables	1.34	0.00	5.01	6.94	9.82	12.77	6.56	2.94	3.60	9.40	0.00	9.59
Manufacturing - nondurables	13.67	10.36	11.13	8.24	13.28	10.23	7.30	3.66	4.09	5.89	0.00	9.51
Construction	9.76	10.89	7.45	7.64	6.09	4.68	6.20	8.03	11.73	6.03	3.71	6.30
Services	62.03	57.55	64.67	66.86	65.52	67.06	71.30	68.08	67.39	68.37	74.07	66.93
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Percent Distribution of Sector Employment by Province, 1981

Sectors	Nfld.	PEI	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	YWNT	Canada
Primary Industries	2.58	0.75	3.68	2.94	15.93	23.93	4.10	6.96	22.16	16.03	0.94	100.00
Manufacturing - durables	0.20	0.00	1.34	1.68	24.44	53.11	2.90	1.00	3.84	11.48	0.00	100.00
Manufacturing - nondurables	2.19	0.37	3.15	2.01	32.34	43.66	3.30	1.27	4.55	7.16	0.00	100.00
Construction	2.33	0.58	3.06	2.77	23.14	29.84	4.22	4.08	19.07	10.77	0.15	100.00
Services	1.39	0.29	2.47	2.26	23.54	40.38	4.53	3.24	10.26	11.39	0.26	100.00

B.2 Methods of Estimating Tariffs for Canada and the U.S. by I/O Commodity

The essential data ingredients for tariff rates by industries or commodities at larger levels of aggregation (medium level I/O industry or commodity) are the tariff rates by detailed tariff lines applicable in 1987 after the Tokyo Round reductions are fully phased in. These data are collected for Canada and the U.S. for calculating comparable tariff rates by I/O commodity (medium level) the procedures of which can be described as below.

Canadian Tariffs

Post-Tokyo Round Statutory tariff rates for all dutiable imports of Canada by tariff-lines are first gathered from the GATT. These tariff rates are the upperbound estimates of duty rates (called bound rates) on tariff-line commodities. By a StatCan concordance of tariff-line (TI) and CITC (Canadian International Trade Classification) (at the 7-digit level), the tariff rate by CITC is obtained using 1979 import weights by TI. In the next phase, we obtain another concordance of CITC with I/O (large) commodities (about 600 in the large set) obtained from StatCan. This provides tariff rates in large I/O commodity space corresponding to 1979 CITC imports of Canada which serve as weights. In the final phase, large I/O commodities are aggregated to 69 I/O (medium)

Table B-4

Canadian and the U.S. Tariffs (Pt) and Tariff Equivalents (Pnt) of NTBs (Standing): Estimates of Tariffs for 1987 and NTBs for 1984 by I/O Commodidity

Commodity	I/O (M)	Canada		U.S.A.	
		Pt	Pnt	Pt	Pnt
		(In percentages)			
Grains	1	1.99	12.50	1.10	0.00
Live animals	2	1.59	11.50	1.00	10.50
Other agricultural products	3	3.07	12.00	4.60	10.50
Forestry products	4	0.00		0.20	0.00
Fish landings	5	0.19		1.50	0.00
Hunting & trapping products	6	0.06		0.00	0.00
Iron ores & concentrates	7	0.00		0.10	0.00
Other metal ores & concentrates	8	0.02		0.20	0.00
Coal	9	0.00		0.00	0.00
Crude mineral oils	10	0.01		0.30	9.00
Natural gas	11	0.65		0.00	0.00
Non-metallic minerals	12	0.36		0.00	0.00
Services incidental to mining	13	0.00		0.10	9.00
Meat products	14	2.21	10.00	1.10	12.00
Dairy products	15	6.39	22.00	10.20	15.00
Fish products	16	1.27		0.80	8.40
Fruits & vegatable prepar.	17	7.17		6.80	0.00
Feeds	18	0.78	0.30	0.80	0.00
Flour, wheat, meal, etc.	19	5.82	6.90	3.80	6.00
Breakfast cereals & bakery prod.	20	7.74	1.00	0.10	8.50
Sugar	21	3.20		16.60	15.20
Misc. food products	22	5.45		2.90	0.60
Soft drinks	23	12.70		0.50	0.00
Alcoholic beverages	24	2.69	40.00	4.70	20.60
Tobacco, raw	25	9.92		11.30	0.40
Cig. & tobacco, manufactured	26	18.32		9,90	0.60
Tires & tubes	27	9.20		3.80	0.40
Other rubber products	28	10.56		11.00	0.40
Plastic fabricated products	29	11.23		11.00	0.40
Leather & leather products	30	12.91	5.00	8.20	0.00
Yarn & man-made fibres	31	6.94		8.30	0.30
Fabrics	32	20.42		10.50	0.60
Other textile products	33	4.14		6.80	0.60
Hosiery & knitwear	34	22.54		14.20	0.20
Clothing & accessories	35	17.09		10.70	0.40
Lumber & timber	36	0.11		0.00	10.00
Veneer & plywood	37	3.94		1.20	0.00
Other wood fabricated materials	38	5.20		3.10	20.00
Furniture & fixtures	39	13.49		3.00	0.00
Pulp	40	0.09		0.00	0.40
Newsprint & other paper stock	41	4.49		0.10	0.25
Paper products	42	7.06		3.00	0.26
Printing & publishing	43	1.73	1.15	0.70	0.22
Advertising, print media	44	0.00		0.00	0.00
Iron & steel products	45	5.96	2.60	3.60	9.50
Aluminium products	46	2.12		0.80	0.00
Copper & copper alloy products	47	3.44		1.20	0.00
Nickel products	48	3.16	1.80	0.90	0.00
Other nonferrous metal products	49	0.93		0.90	0.00
Boilers, tanks and plates	50	8.45		4.30	0.00
Fab. structural metal products	51	6.62	3.50	3.10	0.00
Other metal fabricated products	52	7.20		3.30	0.00
Agricultural machinery	53	0.29		0.10	0.00
Other industrial machinery	54	6.03	1.30	3.30	0.00
Motor vehicles	55	1.33		0.00	0.00
Motor vehicle parts	56	0.51		0.30	0.00
Other transport equipment	57	6.64		1.90	0.00
Appliances & receivers	58	7.88	1.30	4.60	0.00
Other electrical products	59	6.57	1.00	4.00	0.00
Cement & concrete products	60	1.47		0.50	0.00
Other nonmetal. mineral prod.	61	5.81		5.80	0.00
Gasoline & fuel oil	62	0.00		0.10	0.00
Other petroleum & coal products	63	2.86		1.90	0.00
Industrial chemicals	64	6.26		1.90	0.70
Fertilizers	65	0.43		0.00	0.80
Pharmaceuticals	66	4.79		3.20	3.00
Other chemical products	67	6.43		3.10	1.60
Scientific equipment	68	4.10	1.40	4.80	0.15
Other manufactured products	69	9.27	1.00	3.50	0.26
Weighted average (Canadian production weight)		3.84	1.00	2.28	1.8

commodities to obtain medium I/O tariff rates where large I/O imports of 1979 act as weights. The results are presented in Table B-4.

U.S. Tariff Rates

The data for U.S. tariff rates by I/O commodity (large) are obtained from the Department of Finance. The Department gathered Post-Tokyo Round tariff rates (statutory) by the U.S. tariff line (called TSUSA) linked with SITC commodity classification which in turn is further linked with a set of detailed (537) I/O (U.S. input-output, 1977) commodity classification. This estimation is actually done by the Department of Commerce. Such a data set comprising tariff rates by I/O (U.S.) commodity is then linked with the Canadian I/O commodity (large) classification by the Department of Finance. The resultant tariff rate - I/O (large) correspondence by commodity is what we have used for aggregating into I/O (medium) classification where 1983 imports of the U.S. by commodity serve as weights.

The Canada-U.S. tariff rates by I/O commodity (medium) are presented in Table B-4. For the sake of an easy interpretation in the industry space, we have also created tariff rates by I/O industry (medium) with the help of the I/O market share matrix of 1981. This matrix translates commodity tariff rates into industry-specific tariff rates the results of which are shown in

Table 2 in the text. The over-all aggregate tariff rate (for the goods producing sector excluding construction) for Canada is 3.8 per cent which is roughly 150 basis points higher than the U.S. (2.3 per cent). The aggregation here is based on production weights in the industry space.

B.3 Methods of Measurement of Non-Tariff Barriers (NTBs)

1. Types of NTBs Considered

1) Quantitative Restrictions - Quotas and VER
2) Contingency Protection -
    a) Countervailing duties
    b) Anti-dumping
    c) Safeguards (Escape Clause)
3) Customs Valuation
4) Health and Standards
5) Licensing of Imports

2. Methods of NTB Measurement (for Standing NTBs)

Two methods are considered here: 1) coverage ratio method and 2) tariff equivalent method. Coverage ratio method measures the percentage of imports subject to an NTB or NTBs by an importing country in either a bilateral or a multilateral model. Thus, if Canada exports about $4 billion of lumber to the U.S. in a given year, and $3 billion of lumber is subject to a U.S. countervailing duty, then the coverage ratio of the U.S. countervail with regard to lumber is 75 per cent in that year. The coverage ratio does

not represent the actual restrictiveness of imports due to an NTB -- it only shows the extent of coverage of an NTB. For the use and critique of coverage ratios, see Lodh & Magun (1987). The formula for coverage ratio can be expressed in a simple form as follows in a bilateral context.

Coverage Ratio Method (Bilateral)

U.S. NTBs on Canada

$$C^{*\,US}_{j,Can} = \frac{\sum_{i=1}^{\eta} X^{US}_{ij_{Can}} * d^{US}_{ij_{Can}}}{\sum_{i=1}^{\eta} X^{US}_{ij,Can}} * 100 \qquad (1)$$

where

$X^{US}_{ij_{Can}}$ = Export of Canada to U.S. (in current $), commodity i belonging to a broader classification, j.

$d^{US}_{ij_{Can}}$ = dummy variable (one or zero), if NTBs by U.S. apply to Canadian exports of commodity i.

(d_{ij}'s assume a value of unity if NTBs are active, otherwise zero.)

$C^{*US}_{j,Can}$ = percentage of Canadian exports to U.S. subject to U.S. NTBs in a broad product classification, j.

The procedure can be repeated for estimating Coverage ratio of the Canadian NTBs on the U.S. by interchanging subscripts and superscripts. And the same can be manipulated to measure the coverage ratios by type of NTB, namely countervails or antidumping or quantitative restrictions for any number of commodities.

Tariff Equivalents of Standing NTBs (TE)

The tariff equivalent method on the other hand is intended to measure the percentage change in the import price of a commodity that is subject to an NTB by an importing country. Thus, if there is a quota, in Canada for example, on imported shoes of a particular variety from the U.S., the tariff equivalent of the Canadian quota is the percentage increase in the price of the U.S. shoes (of that variety) as a result of the quota. The same result of import restriction by quota could have been achieved by a rise in tariff and hence the nomenclature 'tariff equivalent'. There are two ways of calculating tariff equivalents: 1) the price comparison method (PCM) and 2) the quantity comparison method (QCM) which may be described as below.

a) Price Comparison Method (PCM) (Bilateral)

$$TE_i = [(PE_i^* - PE_i\ (1 + t_i + tR_i)) / PE_i] * 100 \qquad (2)$$

where

TE_i = tariff equivalent of an NTB or percentage change in import price of commodity i due to NTBs put by an importing country (say Canada) on an exporting country (say the U.S.).

PE_i^* = observed import price in the importing country, commodity i.

t_i = tariff rate of commodity i (here imposed on the U.S.).

PE_i = export price, f.o.b. (here U.S.)

TR_i = transport and insurance cost per dollar of PE_i to transfer a commodity i to the importing country.

Very often PE_i^* is not observable and what one obtains is the domestic price of the importing country (PD_i) in place of PE_i^* in Equation (2) the assumption of a perfect substitution between domestic good and imported good is implied as one intends to

obtain a correct tariff equivalent. This assumption does not hold under imperfect competition because PD_i may not move as much as import price may move due to an NTB whereby TE_i would be biased downward. Also various other problems regarding quality adjustments for domestic goods vis-ā-vis imported goods, changes in demand and supply shifts (exogenous to NTBs) and other influences of other NTBs make price comparison method difficult to apply. We have used it from historical records only those PCM-related tariff equivalents that are generally recognized to be valid, e.g., meat and dairy products, alcoholic beverages, etc.

b) Quantity Comparison Method (QCM) (Bilateral)

$$TE_i = \left(\frac{\Delta M_i}{\Delta M_i + M_i}\right) * \frac{(1 + t_i)}{ei} \qquad (3)$$

M_i = present level of imports, commodity i (including the effect of tariffs).

ΔM_i = change in imports due to NTBs, commodity i.

e_i = price elasticity of demand for imports, commodity i.

QCM addresses the question directly: how much an NTB imposed by one country on another has reduced trade? This information given by ΔM_i has to be obtained first from whatever reliable sources one

can lay hands on. Econometric estimates, historical market shares before and after an NTB, industry opinions with respect to actual NTB impacts can all be valuable for the purpose. We have used them very frequently from case studies of NTBs with particular attention to industry opinions of both sides of the border. But once ΔM is obtained, price elasticity of import demand comes into play to obtain TE. Obviously, QCM puts a heavy burden on this elasticity to obtain TE even if the ΔM is found to be reasonable. Elasticities are taken from Maryland model.

The general consensus among NTB specialists is gradually approaching towards a balanced view with respect to PCM or QCM, taking them as complementary to each other rather than as substitutes. For further details, see Lodh and Magun (1987). The tariff equivalents of NTBs by I/O commodity for Canada and the U.S. are presented in Table B-2. For an easy interpretation on industry-space, these tariff equivalents are converted into industry dimensions (I/O industry) using the market share matrix of the Canadian I/O table. The results are shown in Table 2 of the text.

B.4 Government Procurement: Import Displacement by Commodity - Bilateral

Government procurement policies are used to restrict imports in a number of ways. First, domestic procurement agencies may purchase domestically-produced goods in preference to identical foreign-produced goods even when the imported product is lower-priced. This is the premium price preference afforded domestic producers. Secondly, there can be a domestic content requirement by legislation like the Buy American Act, the Surface Transportation Act, and the Urban Mass Transportation Act. Finally, there are other biases due to selection criteria, namely, single-source contracting, domestic set-asides, lack of documentation of tenders, strategic goods (defence or technology-sensitive), etc. The GATT Agreement on government procurement also do not include a) state/purchases of goods, b) federal purchases of services and c) defence goods.

Data and conceptual anomalies confront further obstacles to a realistic appraisal of discriminatory government procurement policies (for clarification, see Lodh and Magun (1987)).

The procedure for trade discrimination by government procurement has been carried out on a quantity basis, i.e., how much imports by commodity are actually (or likely to be) displaced by procurement policies. This approach is preferred because other

evidence of tariff equivalent through a price-comparison method cannot always be obtained across commodities by country. The principal assumption in this approach is that governments compete for imports in the same way as the private sector does.

Thus, for each commodity, the extent of import displacement is determined from the following equation. From the Canadian side, we have thus:

$$\Delta M^{US}_{Can} = U_{Can} * G_{Can} * SH^{US}_{Can} - GM^{US}_{Can} \qquad (4)$$

where

ΔM^{US}_{Can} = hypothetical extra imports that Canadian government would purchase from the U.S. in the absence of procurement discrimination by commodity (commodity subscript here ignored).

U_{Can} = national (Canada) import ratios by commodity.

G_{Can} = government procurement by commodity.

SH^{US}_{Can} = U.S. share in total Canadian imports by commodity.

GM^{US}_{Can} = actual imports of U.S. goods in Canadian government procurement.

The above formula can be rearranged to obtain the U.S. government procurement discrimination by commodity and by type of activity, defence and non-defence.

The data are obtained from the Department of Supply and Services (DSS) for Canadian and the U.S. federal government procurement in goods (defence and non-defence separately) for the year 1984. Due to classification problems, federal procurement in services are not considered in the analysis for Canada and the U.S. The procurement of goods is initially provided by the DSS by NATO Code which then is converted into I/O commodity classification for both Canada and the U.S. National import ratios (taken as private import ratios) are obtained from 1981 I/O table of Canada and 1977 I/O table of the U.S. As regards shares, SH_{US}^{Can}, these are obtained from 1984 computations by the StatCan and 1983 estimates by the Department of Finance (Canada) respectively. For a complete analysis of import displacements by I/O commodity, see Lodh and Magun (1987).

B.5 Subsidies: Producer's Subsidy Equivalent (PSE), Agriculture

(Global Proportional Subsidy or Advalorem Subsidy)

There are two different approaches to subsidy rate calculations which are used for Canada and the U.S.A. by commodity or industry. The first one is what is called producer's subsidy equivalent (called PSE) and this is generally applicable to agricultural commodities because of price support by governments to agricultural producers in general. This involves all trade protection (inclusive of tariffs and NTBs like quotas, target pricing of domestic production). It is a global concept commonly used in trade literature that sums up the subsidy equivalents of all forms of protection and then expresses them as a percentage of producer's value of production actually received (inclusive of direct subsidies). In the absence of price support to commodities other than agriculture, the alternative approach is called subsidy rate (or proportional subsidy here designated as SE).

In both the denominator is the same but the numerator changes. Keeping this in mind, it is worthwhile mentioning another approach commonly articulated by the national accounts subsidy rate (NAS). The comparisons of these three approaches provide the rationale

for the selection of PSE for agriculture and SE for non-agriculture. Thus, we describe:

$$NAS = \frac{D - L + BD}{Q * P_D + D - L} = \text{National Accounts Subsidy Rate} \quad (5)$$

$$PSE = \frac{Q * (P_D - P_W) + D - L + B}{Q * P_D + D - L} = \text{Producer's Subsidy Equivalent} \quad (6)$$

where

D = all direct subsidies (import-competing or export promoting) to producers, e.g., direct payments like deficiency payments, diversion payments, PIK entitlements or cash grants, current or capital.

L = producer levies and fees.

BD = budgetary payments (direct) and budgetary losses of public enterprises.

Q = volume of production.

P_D = domestic producer price.

P_W = world or reference price (inclusive of tariffs, transport costs, etc.).

B = budgetary payments, direct and indirect (indirect payments here refer to the implicit cost reduction that firms/industries benefit, e.g., transport subsidies, fertilizer subsidies, tax relief, lower insurance costs, benefits due to lower than market interest rates, loan guarantees, grace periods and so on).

The distinction between (5) and (6) is apparent in the value of the numerator where PSE includes additional variables like price support, $Q * (P_D - P_W)$ and indirect budgetary payments that are included in B but excluded in BD. There is also another subtle distinction in NAS and PSE: in NAS, for example, transport subsidies in Canada are recorded in transport industry which directly obtains such subsidies and this comes under item D, whereas in PSE, such subsidies are passed on to the industries producing grains who are the final beneficiaries and this comes under the item B. This brings out sometimes substantial differences between NAS and PSE modes of subsidy calculations by industry. But by and large, PSE procedure reflects all subsidies, direct and indirect, and exceeds mostly that of NAS. NAS is, therefore, considered not a very proper method because indirect subsidies are excluded. In 1980s, such indirect (or hidden) subsidies are held to be a growing menace to trade flows. We have followed the PSE approach by commodity. Data here are collected from various sources, notably, U.S. Department of Agriculture,

Agriculture Canada, StatCan, Grains Council and so on (for details, see Lodh and Magun (1987)).

Subsidies: Methods for Estimates of Subsidy Rates, Non-Agriculture

In all industries other than agriculture, the method of subsidy rate calculations is pretty straightforward and is given by the following by industry:

$$SE = \frac{D - L + B}{Q * P_D + D - L} \qquad (7)$$

Note that price support (the differential of P_D and P_W) is absent here but indirect subsidies are included (as in B). Direct subsidies here include cash grants and capital grants but capital grants are translated into the user cost equivalents as estimated by the Department of Finance (this is paraphrased as "current subsidy equivalents" of capital grants by the Department).

Data for the above are obtained from the Salembier-Moroz-Stone study (1987) and further data obtained from a forthcoming study by Moroz and Brown from IRPP especially with respect to the treatment of capital grants by industry. Industry data of 1981 and 1984 are converted into commodity space to obtain subsidy rates by I/O commodity (see Lodh and Magun (1987)).

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